Reducing Russian Gas to Zero:

From „What if“ to „How“?

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Talk Helsinki

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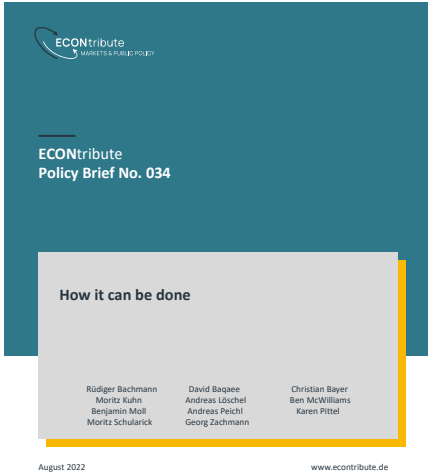
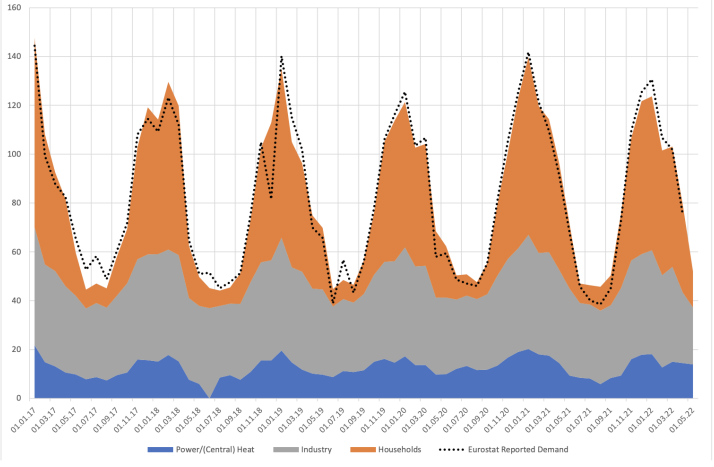
Talk is based on two papers



Important: strong seasonality of gas demand

Figure 2: German natural gas demand (TWh)



What things looked like in March

Facts I: Energy usage & imports

	Oil	Gas	Coals	Nuclear	Renew.	Rest	Total
TWh	1077	905	606	209	545	45	3387
%	31,8	26,7	17,9	6,2	16,1	1,3	100
therof from Russia	34%	55%	26%	0%	0%	0%	30%

- Oil and hard coal has a **global market** (+ a strategic reserve). Thus focus on gas.

We assumed:

- **Reserve capacity** in electricity (lignite, hard coal, nuclear) used **immediately**,
- **Increased imports** from NLD & NOR, & **usage of storage** over summer,
- Immediate stop of imports (e.g., beginning of April)

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- Immediate stop of imports (e.g., beginning of April) ✗

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Facts II: Energy in terms of value

1. Consumption of gas, oil and coal: Germany 4%, France: 2% of GNE
2. Imports of gas, oil and coal: Germany 2.5%, France: 2% of GNE
3. Consumption of gas (also = imports): Germany 1.2%, France: 0.75% of GNE

1.-3. = small numbers. But energy = critical input $\Rightarrow$ amplification important.

In July, prior to the Russian export stop a 210 TWh gap remained

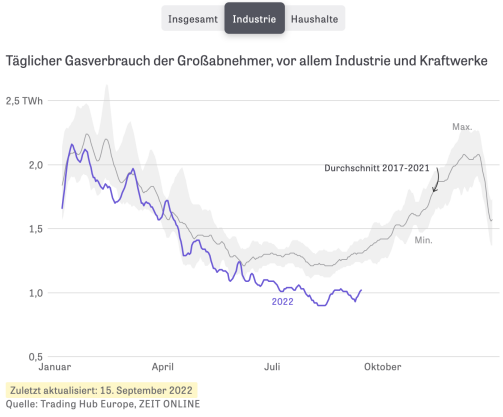
Key table from "How it can be done"paper

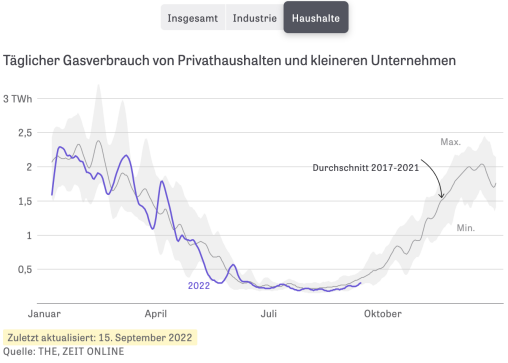
Table 1: Summary of consumption reduction by sector

Demand reduction due to	Reduction August until April (9 months)	Reduction average per month	Relative to consumption in previous years*
Electricity production (Part 1.2.1)	60 TWh	6-7 TWh	45%
Households (Part 1.2.2)	60 TWh	6-7 TWh	16%
Industry (Part 1.2.3)	90 TWh	10 TWh	26%
Sum (= Savings)	210 TWh	23 TWh	25%

* Relative to average consumption in the months of August to the end of April in 2019, 2020, 2021.

Gas consumption by industry and households in Germany

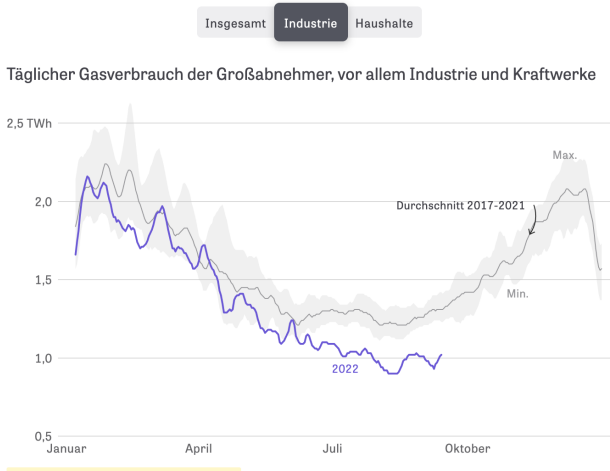




Industry: -22%, households: -19%, overall: -20%

Industry

Gas consumption by industry = -22%



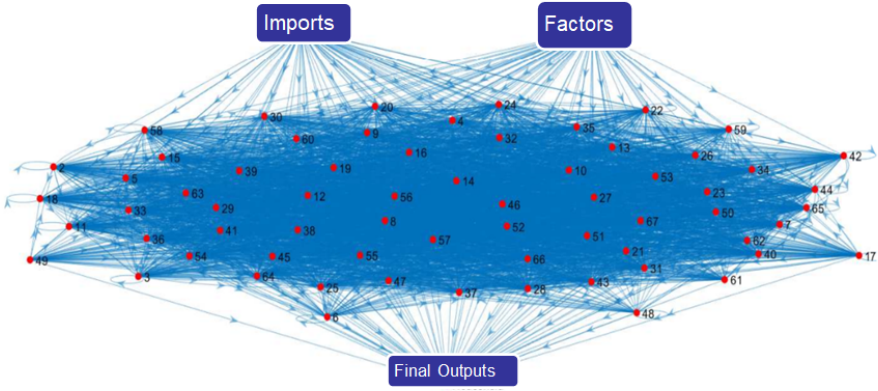
Output losses

Most simple model

$$Y = \left[(1-\alpha)F(K,L)^{\frac{\sigma-1}{\sigma}} + \alpha Gas^{\frac{\sigma-1}{\sigma}}\right]^{\frac{\sigma}{\sigma-1}}$$

- Gas has a small expenditure share, but substitution elasticity might be small.
- Empirical estimates: **short run** (<12 months) demand elasticities -0.4 (Industry) and -0.2 (households)
- A **quadrupling** of **wholesale gas prices** yields -30% consumption.
- We assumed an elasticity of -0.1 : -30% at a more than 35 fold price (ca. 700 €/MWh)

The worry: „cascading effects“ along supply chain



With network structures

Baqaee-Farhi Model

- Input-Output structure (allows for spill-overs and increased damages)
- But: multi country. $\Rightarrow$ Import energy-intense products instead of energy (e.g. basic chemicals, raw metals).
  $\Leftarrow$ Exactly the problem for CO2 taxation (CBAM) comes in handy here, **world market, bulk products**

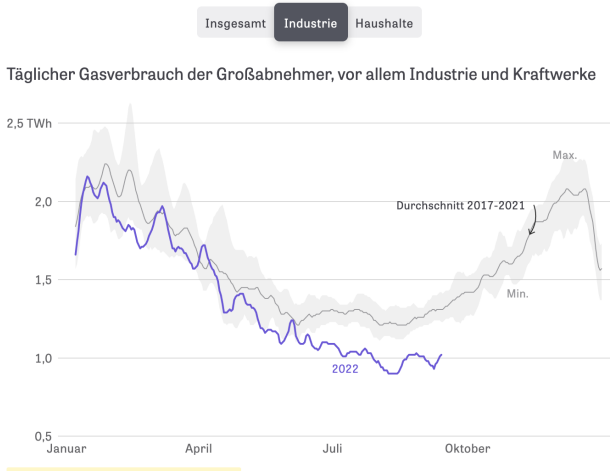
What did we predict back in March?

The numbers

	Baqaee-Farhi (2021), full Model	simple model, 10% energy decline	simplest model, 30% gas decline
GDP Loss, in %	< 0.3	1.3	2.2
per capita (ca., p.a.)	€100	€600	€900

- All Models use conservative elasticity estimates.
- The „simple“ models abstracts from trade.
- The cost statements are in terms of GNE,
- does not factor in transfer of buying power to Norway.

What has happened so far?



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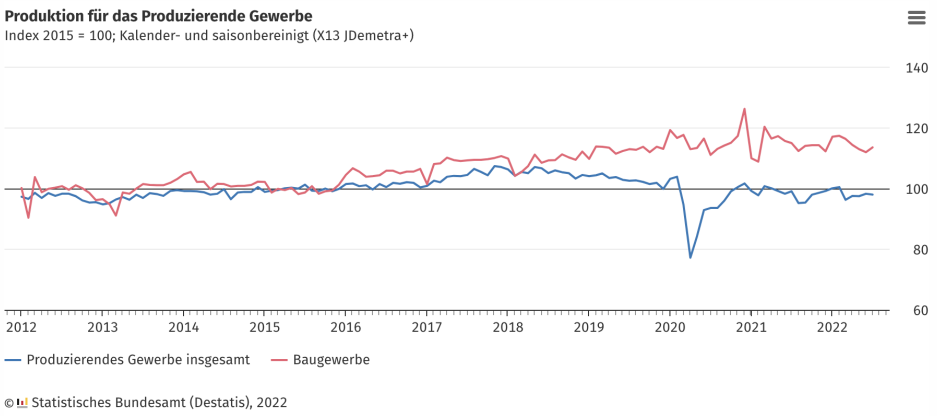


Source: `https://www.destatis.de/DE/Presse/Pressemitteilungen/2022/09/PD22_375_421.html;jsessionid=E39E5DFE885CCCE92ECD12AB03211062.live712`

How so?

How so? Substitution along supply chain and imports

- See examples in this twitter thread
  https://twitter.com/ben_moll/status/1548004135294754817?s=20&t=78Fe5LKpYYWtxmfMD-To-w
- ... and Section 2 of "How it can be done"

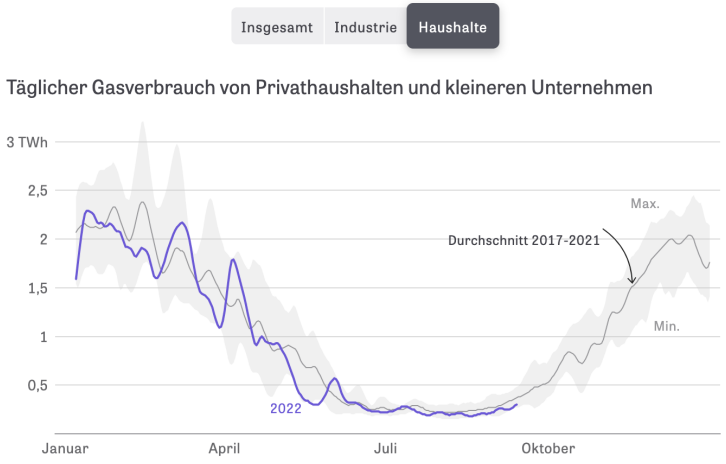
- **BASF**[20] "in Ludwigshafen can replace [with] heating oil about 15 percent of the natural gas needed for electricity and steam generation." Gas for electricity and steam generation accounted for about half of the gas consumed in Ludwigshafen in 2021.[21] **BASF** is also substituting in ammonia production. The company has reduced the production of ammonia at its Ludwigshafen site because of high gas prices and supplemented it with purchases: "this substitution via the world market [is] relatively easy."[22] The company can substitute some by producing ammonia in the U.S. instead of at the Ludwigshafen site.[23] This is a good example of substitution through imports, which we emphasized in our earlier study, in this case even within the same company. A study by Stiewe et al. (2022) examines German fertilizer production, for which **ammonia** is an important precursor, which in turn is produced with gas. The study concludes "that increased ammonia imports have caused domestic fertilizer production to remain remarkably stable." Consistent with these examples, data from Oxford Economics show that chemical imports have surged in recent months.[24]
- Glass manufacturer **Wiegand Glas** will be able to "heat its furnaces with light fuel oil in the future instead of only natural gas as before."[25]
- Car manufacturer **Mercedes-Benz** sees a reduction potential for natural gas of 50% in Germany "if regional pooling is made possible." "For example, at the Sindelfingen site [...] the paint shop can be operated in emergency mode without gas supply."[26]
- Car manufacturer **Audi** says it can get by with 20 percent less gas. Only about 10 percent of normal gas demand, the company says, is "the minimum amount of gas needed."[27]
- Screw manufacturer **Würth** is in the process of converting furnaces that harden the material of screws from gas to electricity.[28] At around one million euros per furnace, the costs are manageable. One problem is that this substitution could take up to 12

... true despite German industry lobby claiming opposite

Source: `https://bdi.eu/artikel/news/substanz-der-industrie-bedroht/`

Not all is good, yet:
Households (and small business consumers)

Gas consumption by households: too early to tell



Weak and dispersed price signals to households

- Typical contract fixes the wholesale price for 12 to 24 months
- Price adjustments thereafter regulated in §315 BGB
  - Law is basically a cost plus regulation,
  - but legal definition of cost unclear: opportunity cost or actual payments?
- Leads to weak price signals and dispersion thereof.

Yet, household demand reduction in winter will be critical

- Absolutely crucial to support households, especially economically weaker ones, in the face of rising gas prices
- Should be done by means of transfers that are not directly tied to gas consumption and that preserve incentives for reducing gas demand
- Textbox in “how it can be done”paper: compensation based on previous year’s consumption

Details that matter

The contract structure of (protected) end users

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- Reduces savings incentives for this winter and makes incentives inconsistent.
- Heterogeneous incentives strain solidarity-based behavior.
- Some households still pay 10 ct/kWh, others 30 ct/kWh.
- Utilities' losses in low-price contracts: high volumes $\times$ loss margin.

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- Some households still pay 10 ct/kWh, others 30 ct/kWh.
- Utilities' losses in low-price contracts: high volumes $\times$ loss margin.
- **But:** Interference with contractual rights not unproblematic.

Example: Families O and N

	Family O	Family N
last annual consumption	15.000 kWh	15.000 kWh
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Gas price 22/23	10 ct/kWh	30 ct/kWh
(Opportunity) costs utility	30 ct/kWh	30 ct/kWh
midrule Expected consumption	15.000 kWh	85% * 15.000 kWh
Expected heating costs	1500 €	3825 €
Loss utility	3000€	0€

Our proposed intervention

Compensate conversion of contracts

- Customers must switch to utility's new contract terms.
- Utility company must compensate according to price difference.
- Based on proven consumption of gas/electricity connection in 2021.
- Data is in most cases already available to the utility company.
- Only in case of contract change (or new connection) must be estimated/collected.

Example: Families O and N - allocating efficiency gains to consumers

	Family O	Family N
last annual consumption	15.000kWh	15.000kWh
last energy price	10 ct/kWh	10 ct/kWh
fixed price ends	end of February 23	end of August 22
Gas price 22/23	10 ct/kWh	30 ct/kWh
(Opportunity) costs supplier	30 ct/kWh	30 ct/kWh
Expected consumption	15.000kWh	85% * 15.000kWh
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	Family O	Family N
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price fixing ends	end of february 23	end of august 22
New gas price 22/23	30 ct/kWh	30 ct/kWh
(Opportunity) cost supplier	30 ct/kWh	30 ct/kWh
Credited compensation	3000€	0€
Expected consumption	85% * 15.000kWh	85% * 15.000kWh
Expected heating costs	825 €	3825 €
Loss utility	3000€	0€

Allocating efficiency gains to consumers

- Family is better off.
- Without behavior change, it has the same gas bill, thanks to compensation.
- With 15% consumption reduction here: family has 675€ more in their pocket.

- Utilities have no additional costs compared to status quo.
- When crediting compensation to future bills:
  not even down payments don't even have to be adjusted!

- No additional cost to the treasury either.
- No inflationary effect, since there is no increase in the cost of heating.

Additional relief measures for families can easily build on this

Relief to customers with contracts that already have high marginal prices

- Install a minimum compensation, e.g. 4.5 ct/kWh,
  (if applicable, costs for treasury).
- In the example 675€. Advantage: only where necessary, where prices already high!

Example: Families O and N - baseline

	family O	Family N
last annual consumption	15.000kWh	15.000kWh
Gas price 22/23	30 ct/kWh	30 ct/kWh
Credit	3000€	0€
Expected consumption	85% * 15.000kWh	85% * 15.000kWh
Expected heating costs	825 €	3825 €

Example: Families O and N - with minimum compensation 4,5ct/kWh

	family O	Family N
last annual consumption	15.000kWh	15.000kWh
Gas price 22/23	30 ct/kWh	30 ct/kWh
Minimum compensation*	0€	675€
Credited compensation	3000€	0€
Expected consumption	85% * 15.000kWh	85% * 15.000kWh
Expected heating costs	825 €	3150 €
Financial relief	675€	**675€**
Saved gas relative to 2021	2,250 kWh	2,250kWh

*approx. cost as 7%-VAT gas, as taxable income if applicable

Example: Families O and N - when subsidizing prices (VAT-cut)

	family O	Family N
last annual consumption	15.000kWh	15.000kWh
Gas price 22/23	8.8ct ct/kWh	26.4 ct/kWh
Minimum compensation	0€	0€
Credited compensation	0€	0€
Expected consumption	102% * 15.000kWh	87% * 15.000kWh
Expected heating costs	1350 €	3445 €
Financial relief	**150€**	**380€**
Saved gas relative to 2021	**-300 kWh**	**1,950kWh**

Same financial cost, more consumption, more burden on utilities

Conclusion

- It can be done
- Demand reduction is key because full gas storage alone is not enough to get through winter without Russian gas (see storage paper)
- New examples of substitution possibilities in industry on daily basis but expect production cuts in some sectors
- Household demand reduction in winter will be critical
  - key: alleviate hardship but without destroying incentives
- Make sure that prices work (uniformly) in the EA