Incineration: What's the Effect on Gas Consumption?

What does the Energy Crisis Mean for Zero Waste?

Zero Waste Europe

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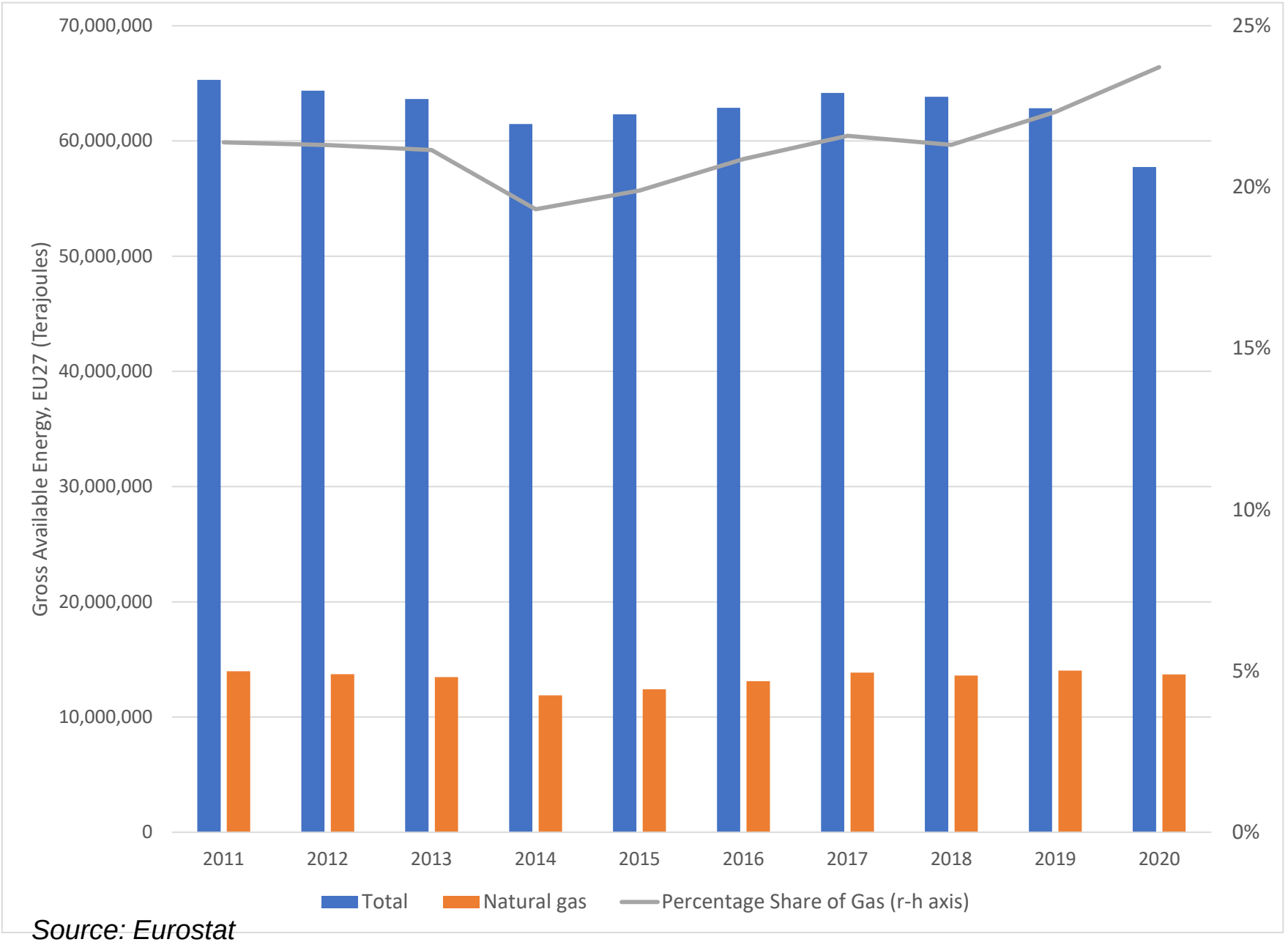
Outline

1. Gas in EU27
2. Incineration's Contribution to Electricity and Heat
3. Impact of Incineration on Fuel Use
4. Forward Look

Gas Use in EU-27

Gross Available Energy, EU27, 2011-2020



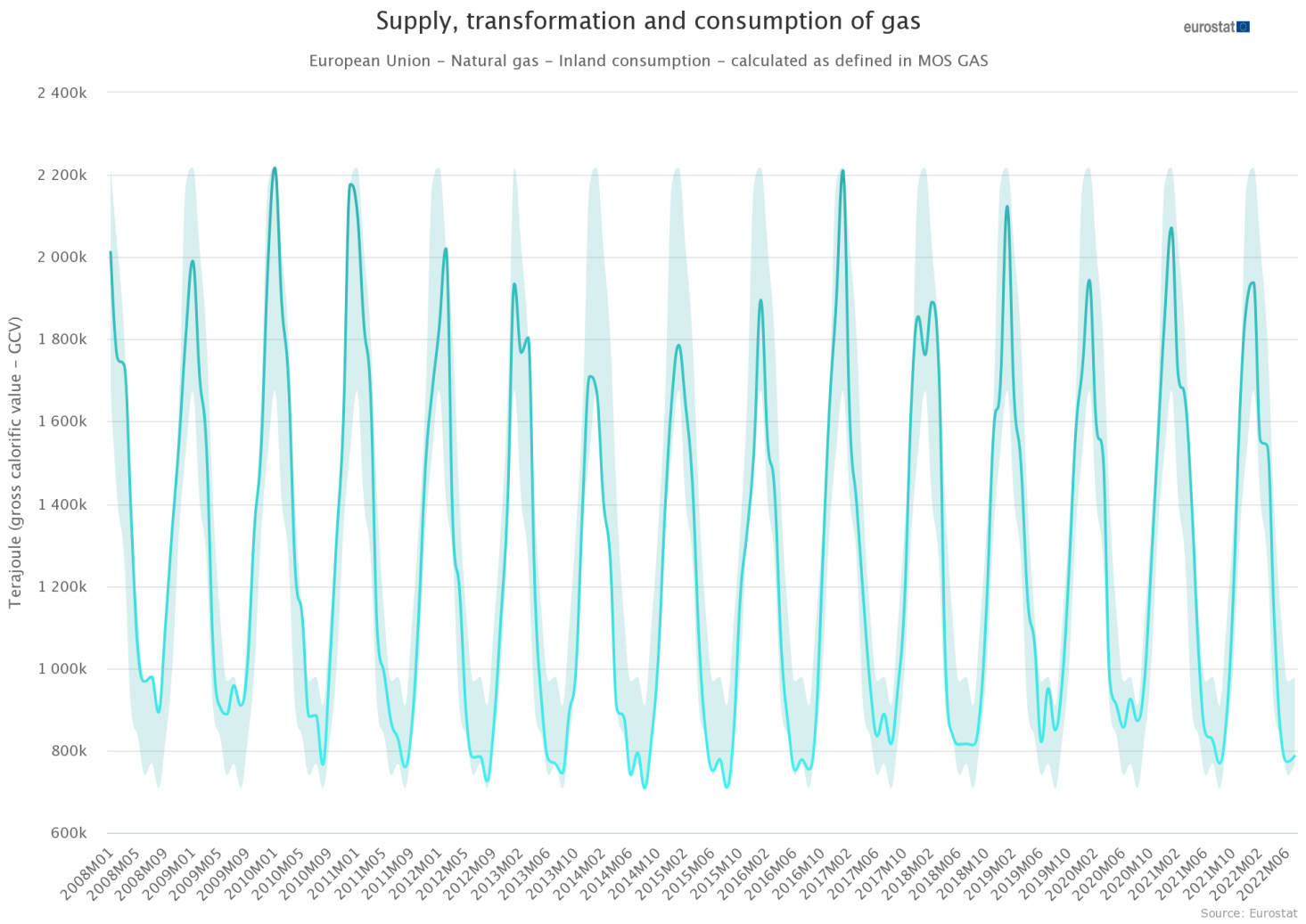
In absolute terms, gas contribution has fluctuated (about the same in 2020 as 2011)

Its *share* of Gross Available Energy in EU27 has been increasing, partly due to recent decline in consumption:

- 19% in 2014
- 24% in 2020

Source: Eurostat

Inland Consumption of Natural Gas, EU27, Jan 2008 - June 2022



Significant seasonal fluctuation in consumption due to role of natural gas in heating, but also its role in electricity generation (demand for which also increases in winter)

Source: Eurostat

Gas - Consumption Splits and Trade Balance

	2019		2020	
Observed Consumption	15,576,437		15,170,927	
Transformation input - energy use	4,960,304	32%	4,861,608	32%
Energy sector - energy use	584,900		569,308	
Gross electricity production	2,049,885		2,016,187	
Gross derived heat production	807,396		791,126	
Final Consumption				
Energy use / non-energy use, industry sector	4,229,782	27%	4,105,152	27%
Energy use, transport sector	173,918		147,094	
Energy use, other sectors	5,562,930	36%	5,433,963	36%
Of which, households	3,702,375	24%	3,653,885	24%

Consumption in the main split between input for

- 'transformation' (energy sector),
- Industrial energy / non-energy use
- Energy use by other sectors (majority of which, by households)

	2019	2020
Primary production	2,188,162	1,725,189
Imports	15,084,182	13,785,912
From Russia	*6,461,869*	*5,929,770*
Exports	2,504,985	2,336,343
Stock change	-733,247	521,419
Gross Available Energy	14,034,112	13,696,177

Approx 40% of imports from Russia

means that (stock changes

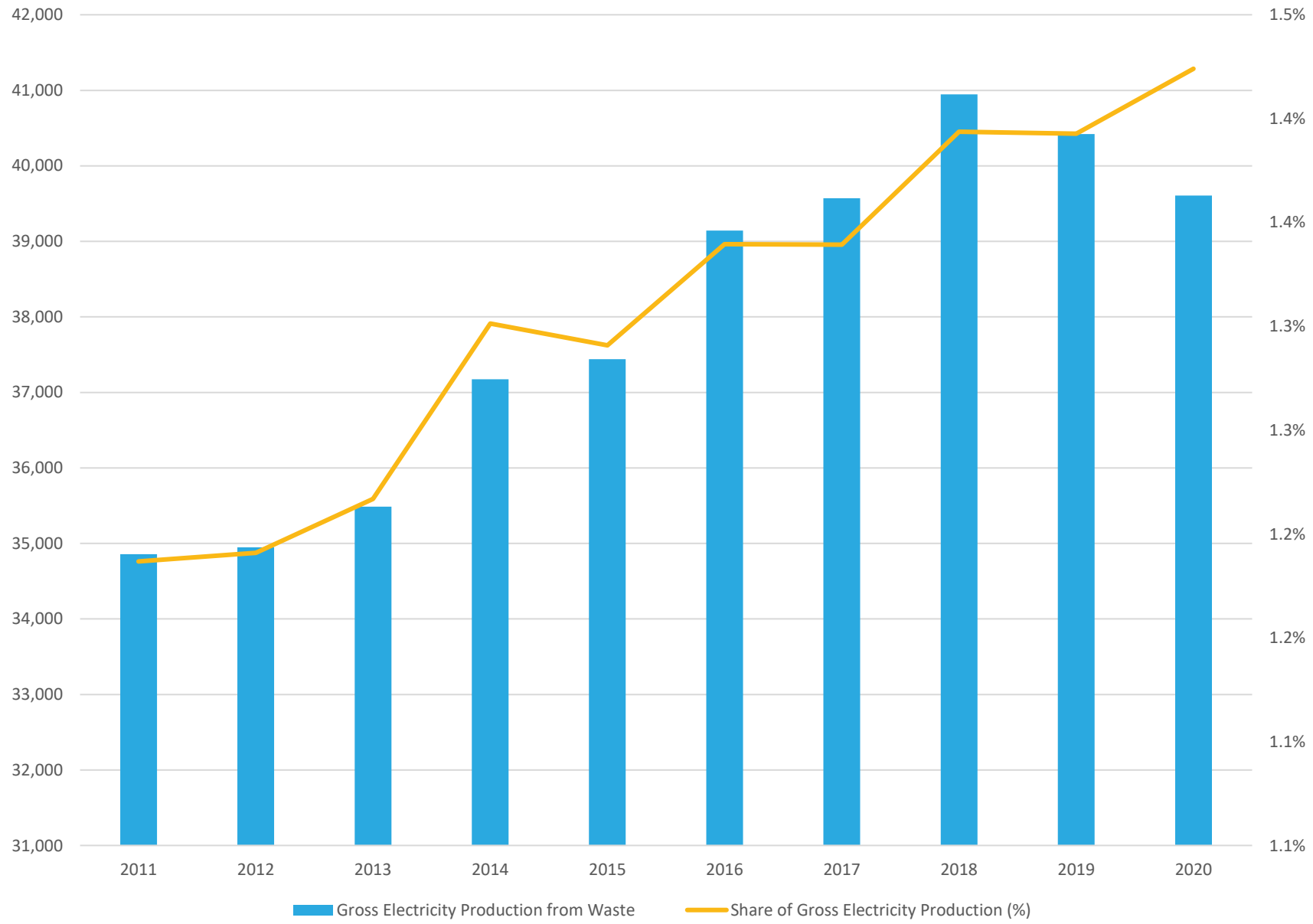
gas is roughly equal to the amount imported

Source: Eurostat

All figures expressed as Gross Calorific Value (Terajoules) except gross electricity and gross derived heat production (expressed as TJ produced)

Incineration

Gross Electricity Production from Waste, GWh and % Total, EU27



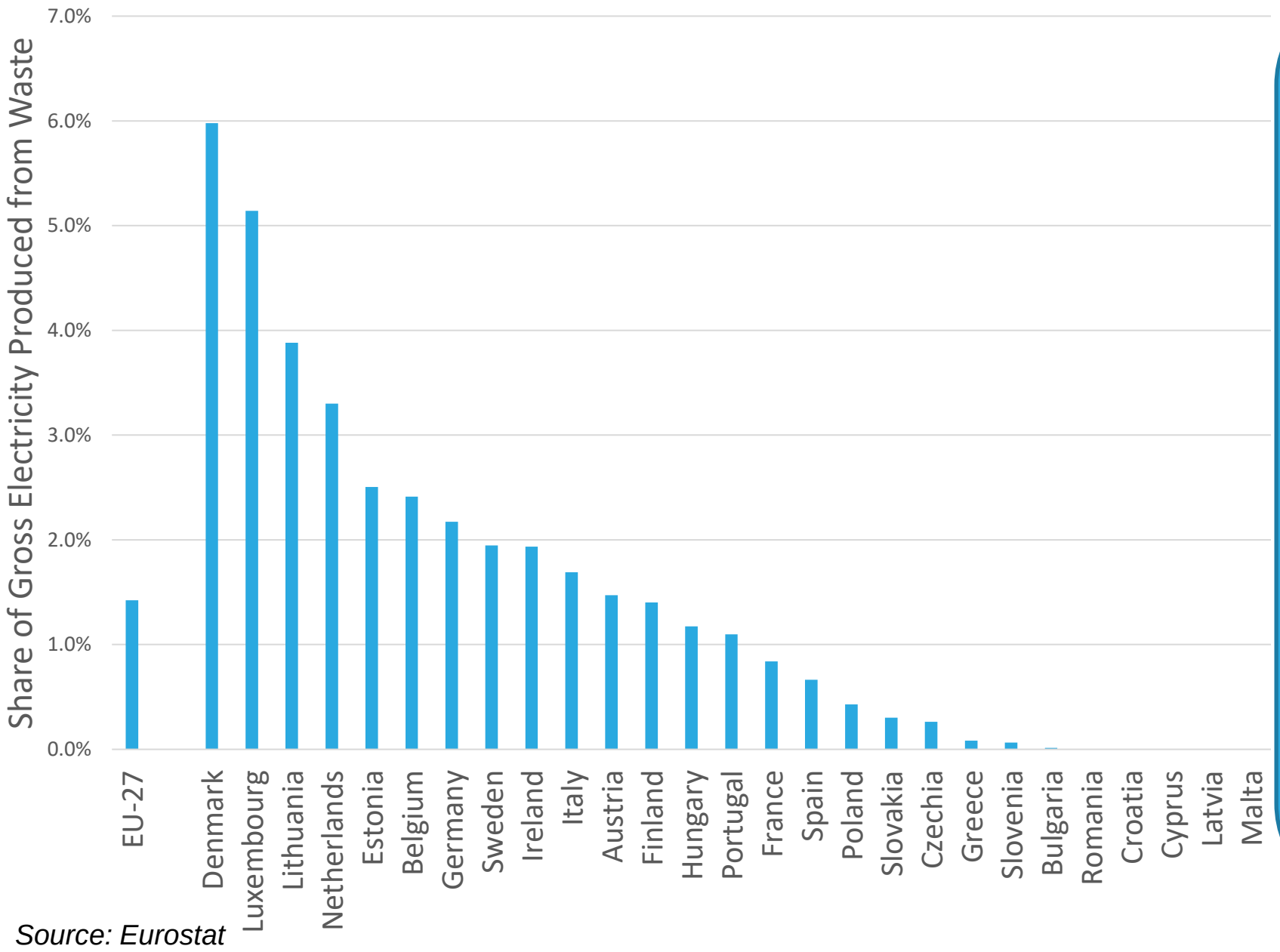
Waste's contribution to Gross Electricity Production = 1.4% of total

- Up from 1.2% in 2011
- Increase of approx. 6,000 GWh

For context, the share of solid fossil fuels has fallen from 25% to 13% over the same period

Source: Eurostat

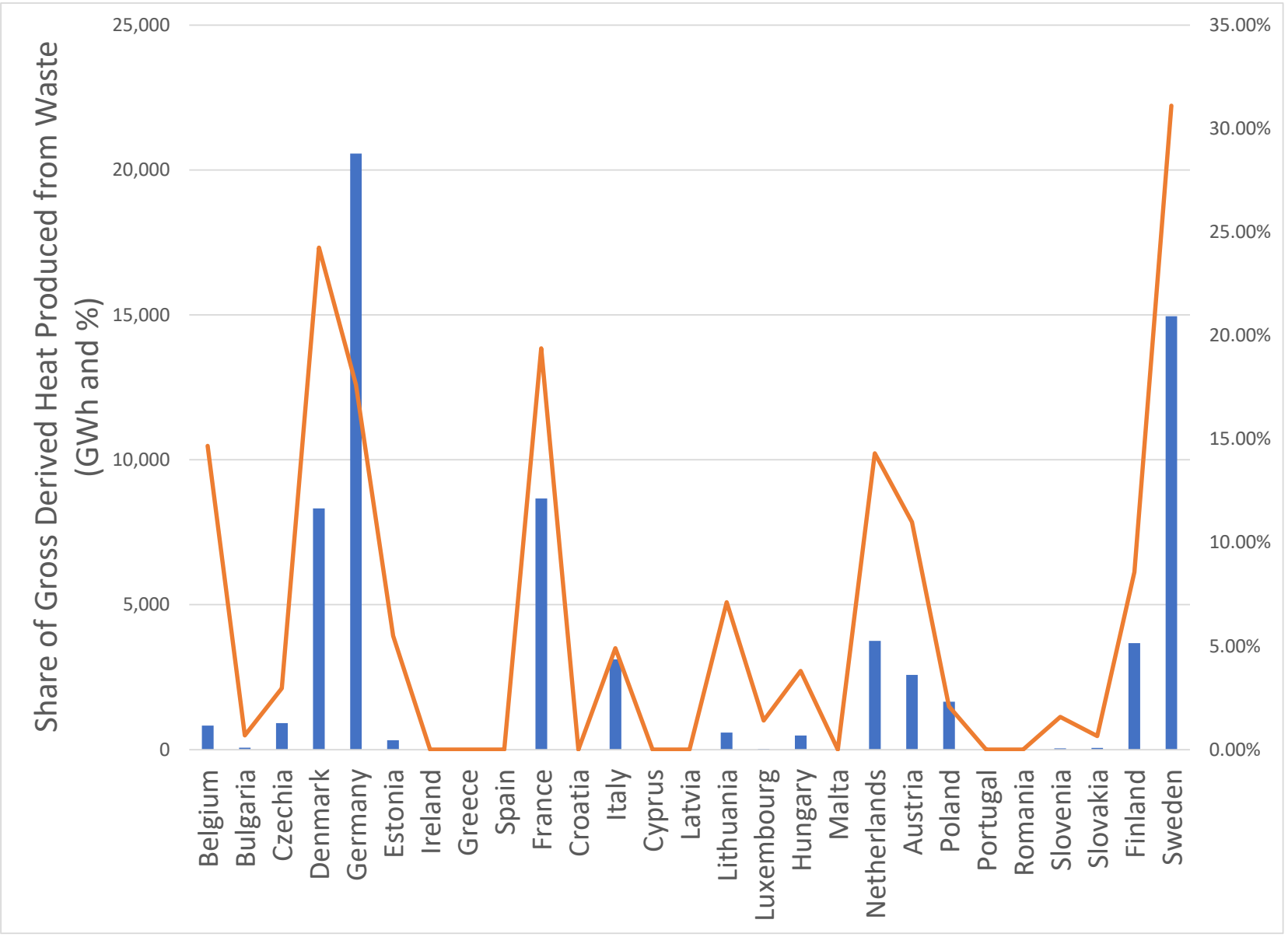
Gross Electricity Production from Waste by Member State, as % Total, 2020



- There is a story behind the numbers
- e.g. Denmark – electricity (and energy) production is influenced by Nordpool pricing / trading arrangements
- Shares can increase even as generation remains constant
- Most countries with higher shares have seen little change in absolute terms (and may be importing waste)

Source: Eurostat

Gross Derived Heat Production from Waste by MS, GWh and % Total, 2020



- Some Member States report no gross *derived* heat
- They use waste to generate electricity, e.g. Spain)
- Gas used for heating reported in final consumption
- For others, waste is mainly used for (district) heat rather than electricity (e.g. Sweden)
- Hence, wide variation in reporting **(treat this graphic with caution)**

Source: Eurostat

Impact on Use of Gas

Unrealistic Upper Bound – All Electricity and Gas Displaces Heat

Electricity

- All electricity generation (a) displaces gas fired electricity generation
  - Uses EU27 average conversion efficiency for gas fired electricity generation (b) to convert electricity produced from waste to an equivalent energy value for the gas used to generate the same (gross) electricity (c,d)
  - Expresses result as % EU27 gas consumption (e)
- This might overstate the displacement:
  - Figures reported gross - as much as 20% of gross generation (e.g. DE) may be used by facilities – parasitic load may be lower in gas-fired facilities
- 1.9% of gas consumption

(a) 39,607 GWh

(b) Divide by eff = 0.495

(c) Convert to TJ (divide by 0.277778)

(d) 288,050 TJ Gas

(e) 1.9% of Gas Consumption

Unrealistic Upper Bound – All Electricity and Gas Displaces Heat

Gas

- All gross heat generation (a) displaces heat produced from gas
  - Assumes conversion efficiency to (gross) heat from gas of (b) to convert heat produced from waste to an equivalent energy value for the gas used to produce the same (gross) derived heat (c,d)
  - Expresses result as % EU27 gas consumption (e)
- 1.8% of EU27 Gas Consumption

All Energy Displacing Gas: All Elec and Heat Displaces 3.7% of Gas

(a) 70,616 GWh

(b) Divide by eff = 0.95

(c) Convert to TJ (divide by 0.277778)

(d) 267,599 TJ Gas

(e) 1.8% of Gas Consumption

Average Mix – All Electricity and Gas Displaces 'the Mix of Other Fuels'

Electricity

- All electricity generation (a) displaces gas to the extent that it is represented in the electricity production mix
  - Uses EU27 average contribution of gas fired electricity generation to the derive a 'gas share in the mix' (normalising after removing waste's contribution) (b) to scale down the 'unrealistic upper bound' estimate (c)
  - Expresses result as % EU27 gas consumption (e)
- This might overstate the displacement:
  - Figures reported gross - as much as 20% of gross generation (e.g. DE) may be used by facilities – parasitic load may be lower in gas-fired facilities
- 0.4% of gas consumption

(a) 39,607 GWh

(b) 20.4% (normalised for removal of waste share)

(c) 1.9% of Gas Consumption

(d) 0.4% of Gas Consumption

Average Mix – All Electricity and Gas Displaces 'the Mix of Other Fuels'

Gas

- All heat generation from waste (a) displaces gas to the extent that it is represented in the electricity production mix
  - Uses EU27 average contribution of gas to derived heat generation to derive a 'gas share in the mix' (normalising after removing waste's contribution) (b) to scale down the 'unrealistic upper bound' estimate (c)
  - Expresses result as % EU27 gas consumption (e)
- This might understate the share of gas displacement:
  - Assumes displacement is 'within' the derived heat production system
- 0.7% of gas consumption

(a) 70,616 GWh

(b) 40.2% (normalised for removal of waste share)

(c) 1.8% of Gas Consumption

(d) 0.7% of Gas Consumption

Average Mix: All Elec and Heat Displaces 1.1% of Gas

Forward Look

A Perspective

What Contribution Can Incineration Make to Reducing Gas Consumption (15% target)?

- Displacement of fuels from existing capacity is a matter for debate (forthcoming report will consider this), but without additional capacity, the change in the level of displacement will be fractional:
  - Marginal increases in capacity utilisation for electricity? Or heat? Or cogeneration?
  - Marginal increases in use of waste for coincineration?
- By the way, these can (by and large) happen today
- Real question is in relation to whether a) there is a case for new incineration capacity, and b) what would be the effect on gas consumption?
  - Should new incineration infrastructure be planned on the basis of turbulence in energy markets occasioned by a war?
  - If planning commenced today, a facility might be operational in, say, 7 years (min 4?)
  - If we do the right thing, we'll increase capacity to deal with waste at existing incinerators
- What's the the most plausible counterfactual in relation to energy supply?
- Hopefully, MSs speed up decarbonisation whilst enhancing security of energy supply
- If new capacity were justified, it might displace alternative low-carbon firm sources
- Gas may be restricted to matching variable generation from renewables .

Thanks

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Old White Man
Born at 0.2 degrees C above 1800 levels

Report due at just over 1.1 degrees C (soon)