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## Assessment of energy efficiency of metals, pulp & paper and commerce sectors – the challenge with indicators

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Fair energy

## Goal of the study

- Introduce energy efficiency of three industrial sectors:
  - pulp and paper
  - metals
  - and commerce.
- *Energy efficiency* =  $\frac{\text{Energy output}}{\text{Energy input}}$  (of a service or a product during a certain time)
- What strengths and weaknesses exist within different indicators?



Photographer: Marjaana Pato / <https://www.flickr.com/photos/94704573@N03/24178860305>

## Energy saving results by JRC, IEA and ODYSSEE - differs a lot!

	Energy savings ktoe	Finland	Sweden	Germany	Italy
Ind+serv.*	<b>FEC** 2015 (as by JRC)</b>	<b>13,972</b>	<b>15,381</b>	<b>95,305</b>	<b>44,155</b>
Ind+serv.*	IEA 2000-201(5)	700	4,100	7,300	
Ind+serv.*	JRC 2005-2015	-221	3,251	8,704	11,125
Industry	ODYSSEE 2000-2015	1,425	2,548	8,240	9,115
Households	<b>FEC 2015 (as by JRC)</b>	<b>4,898</b>	<b>7,197</b>	<b>53,171</b>	<b>32,495</b>
	IEA 2000-2015	300	2,500	27,000	
	JRC 2005-2015	1,018	1,307	15,980	-768
	ODYSSEE 2000-2015	471	4,365	23,310	3,546

\*Ind.+serv. = Industry branches and the service sector are combined

\*\*FEC = Final Energy Consumption is given as reference of consumption level

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# Pulp and paper production

# Indicators for pulp and paper



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ODYSSEE  
old approach

ODYSSEE current  
approach

IEA, JRC approach

	Energy consumption of <b>pulp&amp;paper</b> per <b>paper tons</b> , MWh/t	Energy consumption of <b>pulp&amp;paper</b> per <b>pulp&amp;paper</b> tons, MWh/t	Energy intensity of pulp, paper and <b>printing</b> , MWh/1000€
Finland	6.61 ( 0.9%)	3.41 (- 1.8%)	20.66 (- 8.7%)
Sweden	7.47 ( 4.3%)	3.61 ( 4.3%)	17.80 ( 62.9%)
Italy	3.08 (- 9.4%)	3.08 (- 3.4%)	2.87 (- 3.7%)
Lithuania	2.48 (-73.2%)	2.48 (-73.2%)	1.00 (-80.8%)
UK	6.18 ( 43.5%)	6.18 ( 43.5%)	2.10 ( 7.7%)



Change of unit consumption/ energy intensity; 2000-2015 in brackets

## What also makes a difference?



Photographer: Maximilian Oeverhaus: <https://www.pexels.com/fi-fi/kuva/lumi-puu-talvi-jaatynyt-7317975/>

- In pulp and paper industry, the pulp process consumes a lot of energy -> is a "burden" to the country producing pulp
- Northern weather conditions -> it is different to make pulp from frozen logs than non-frozen 😊
- Excess heat can often be utilized in the cold countries.

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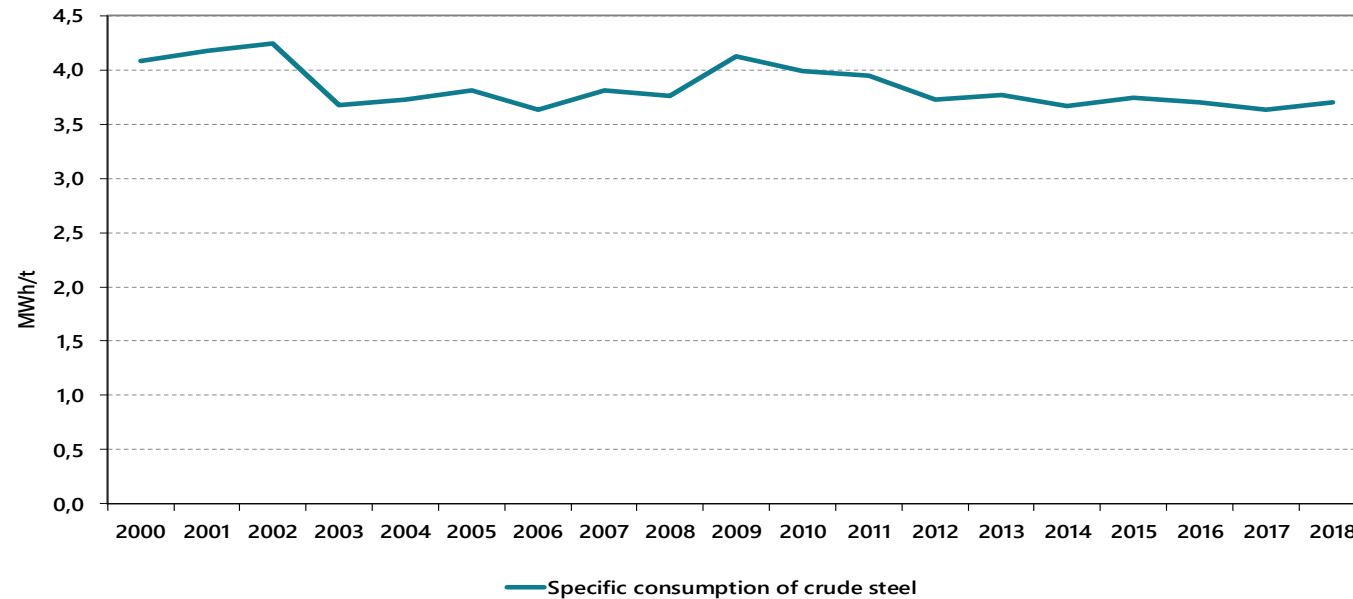
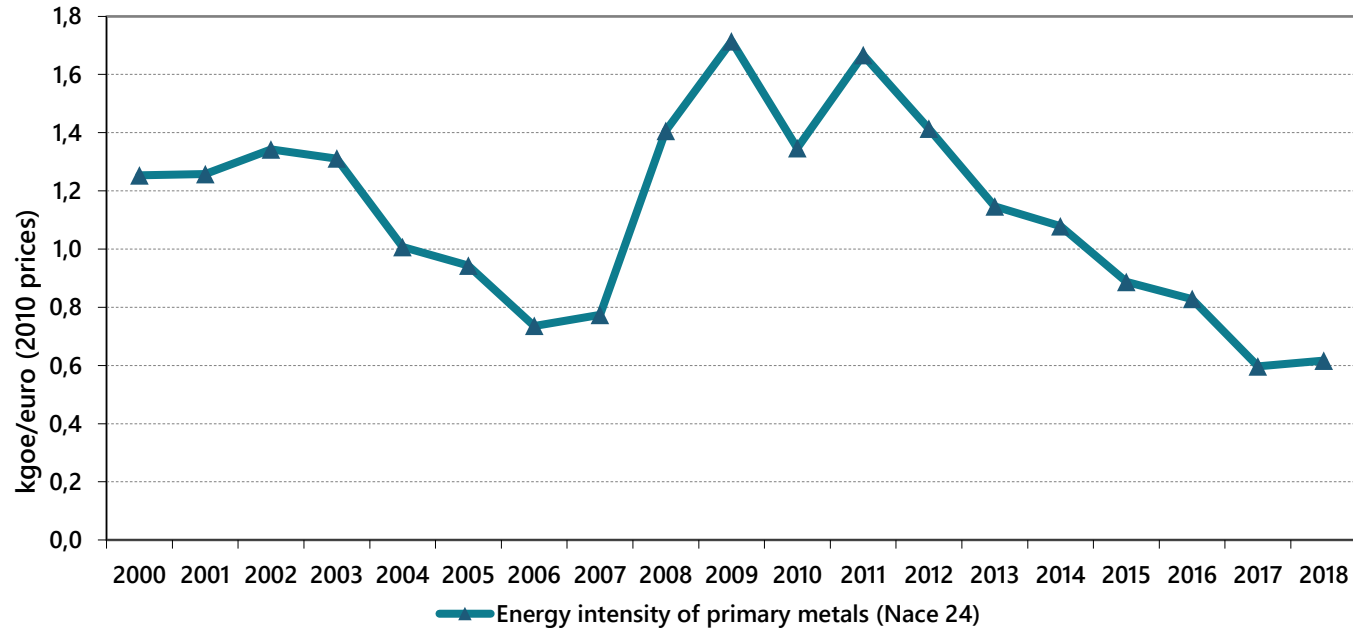
# Metals production



# Energy Intensity of Primary Metals Production in Finland and Specific Energy Consumption of Crude Steel Production in Finland



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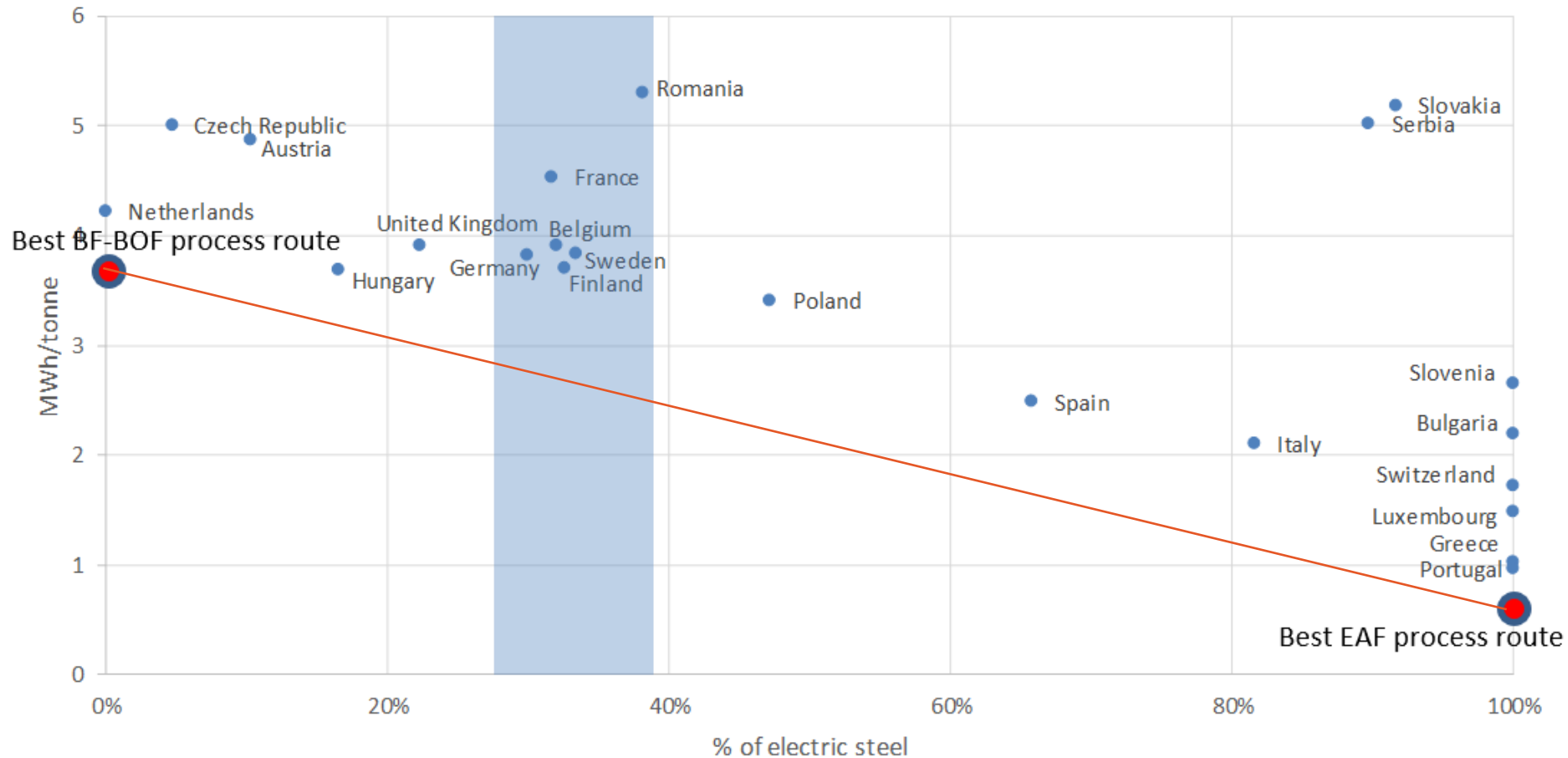
While energy intensity – along with value added – went roller coaster in 2009-2011 due to economic reasons, specific energy consumption remained relatively steady.

Note: Energy consumption includes also stainless steel and ferrochrome production and production of some metal products.





# Specific Consumption of Steel Production by the Production Route in Europe in 2018

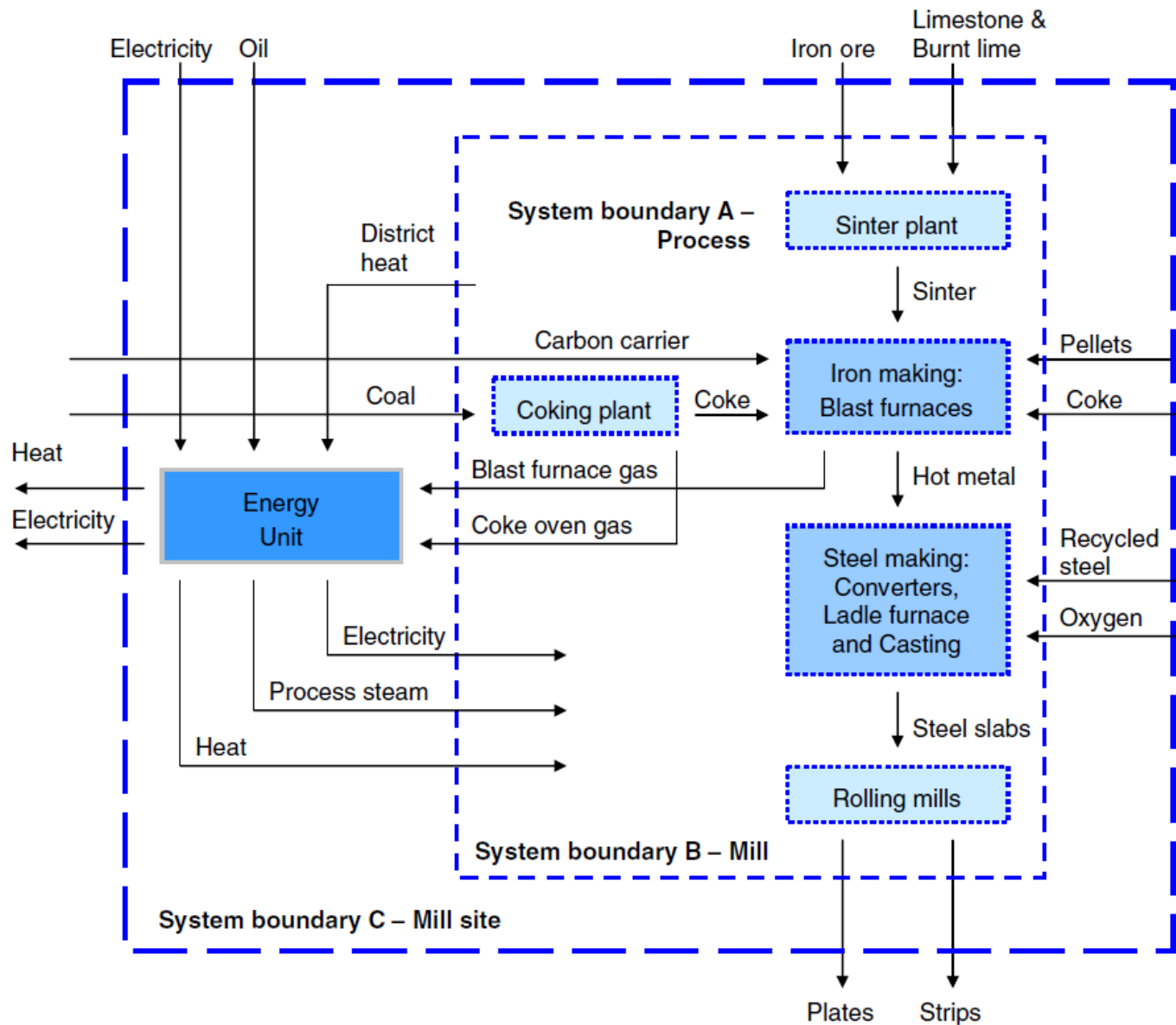


Compare only countries where the share of electric steel is about the same. One third of steel produced in Finland is electric and Finland ranks the best among similar countries. Note: Energy consumption includes stainless steel and ferrochrome production, production of some metal products and thermomechanical processing which is not related to the production of crude steel. These blur the results.

BF-BOF: blast furnace, oxygen steel  
EAF: electric steel  
Source: Odyssee database  
November 2020

# System boundaries of a steel plant

## - factors affecting energy efficiency indicators

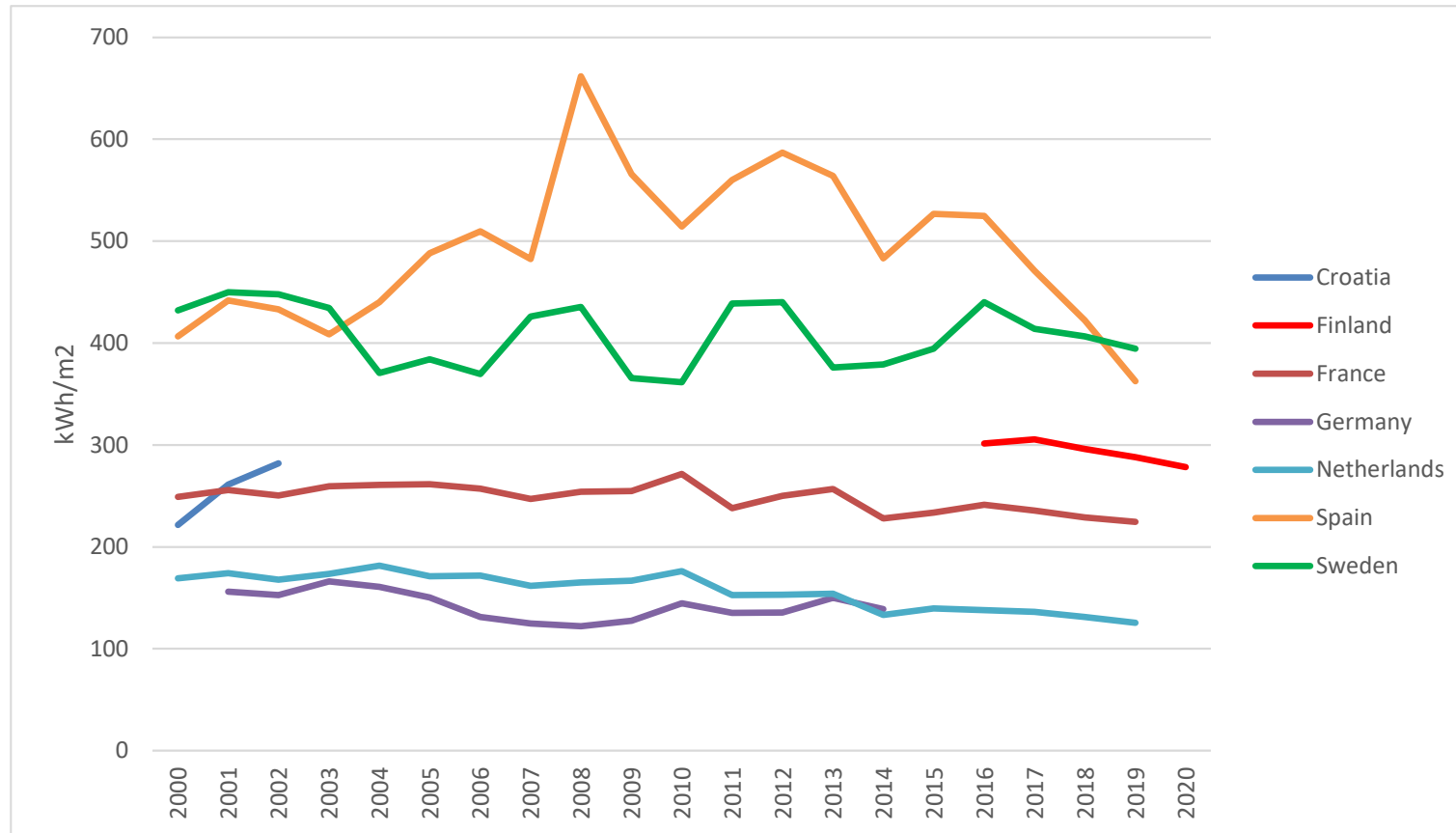


- Industry structure and ownerships
  - How the process involves and who owns e.g. sinter plant, lime plant, coke plant, oxygen plant and especially energy unit
  - Secondary processing (e.g. rolling) varies significantly depending on the product mix
- This figure applies to only oxygen crude steel, different for stainless steel and ferrochrome production.

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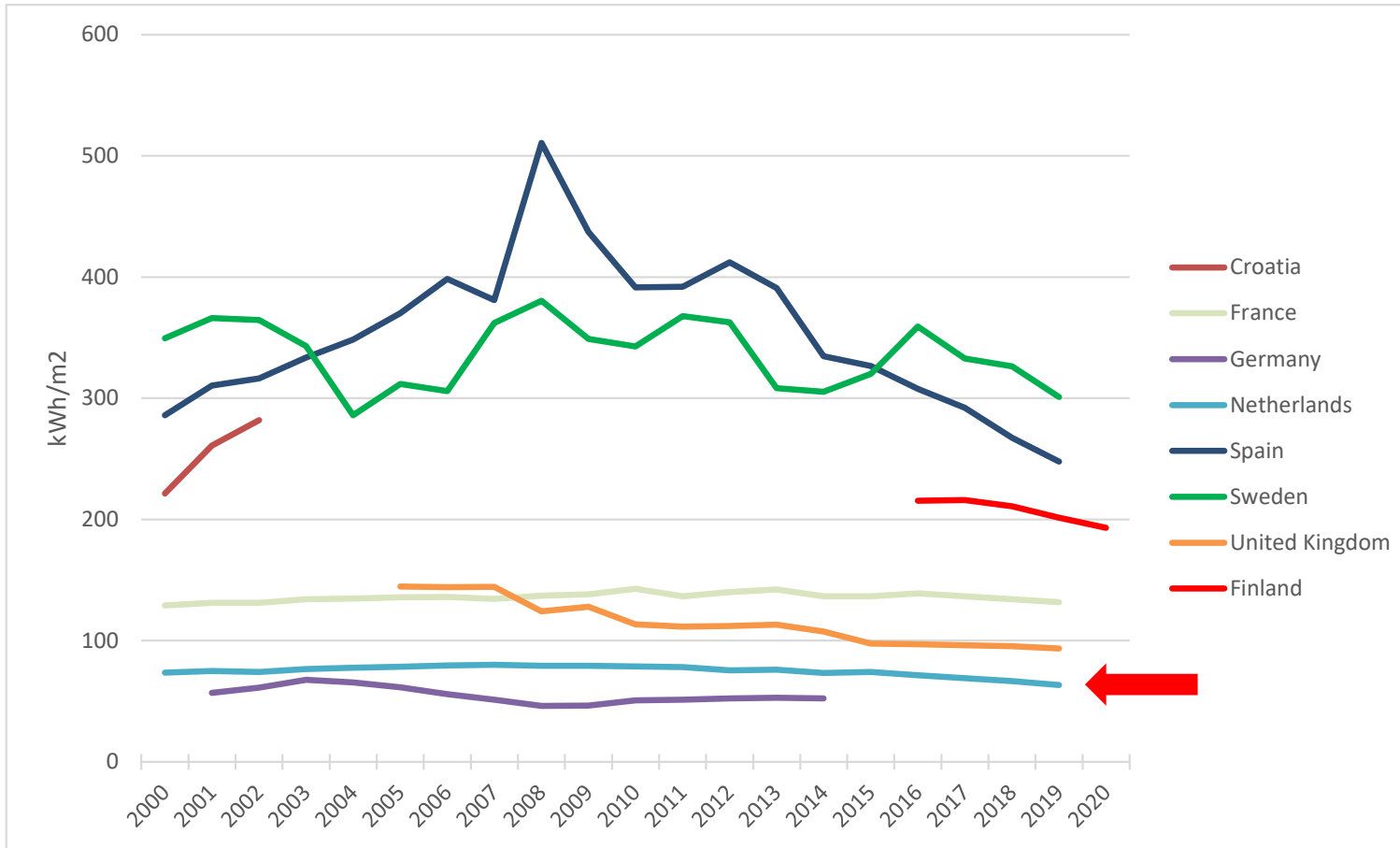
# Wholesales and trade

# Total Final Energy Consumption per Floor Area in Wholesales and Trade in 2000-2019/2020



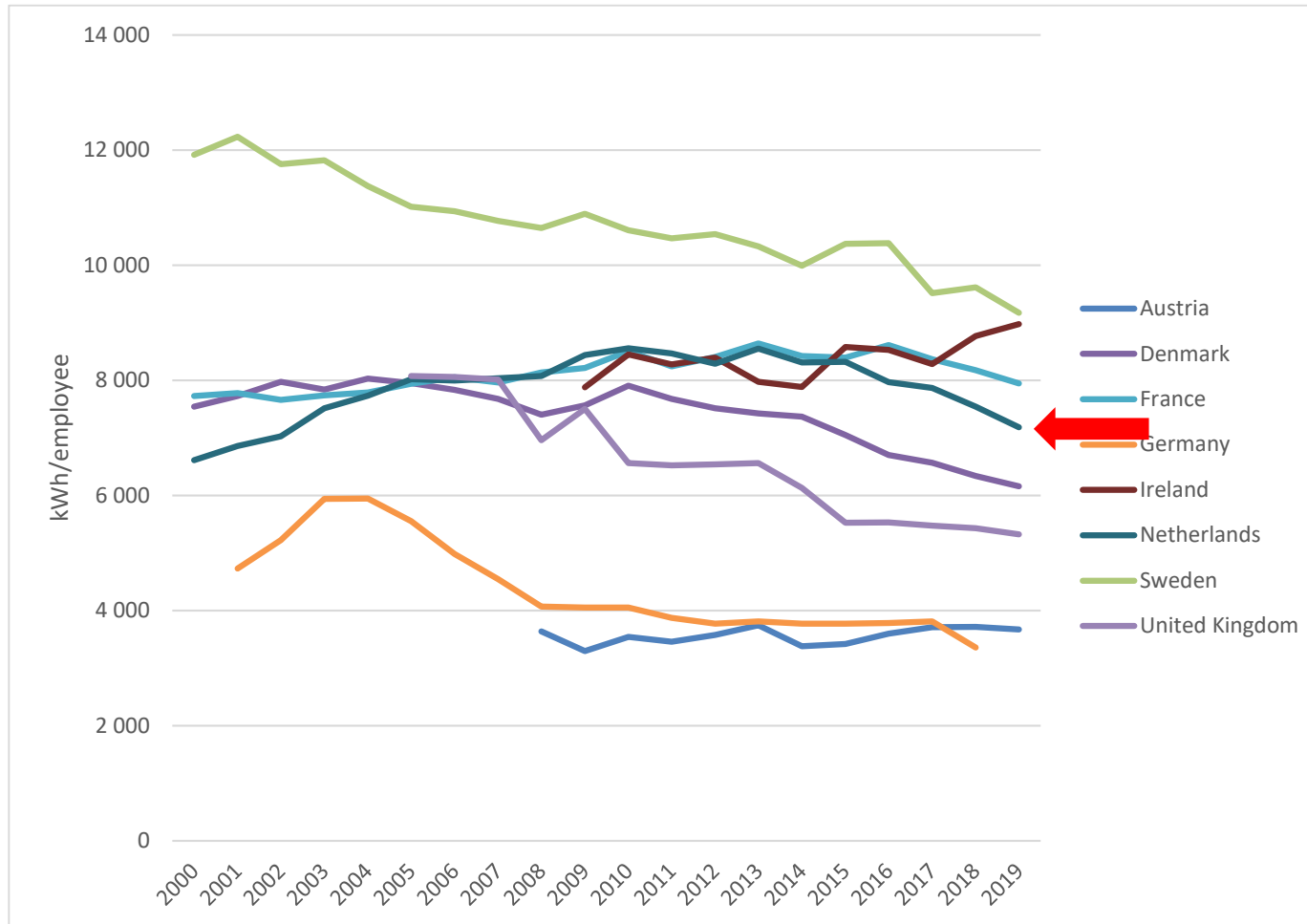
Despite the cold climate, total final consumption per floor area in Finland is in the mid range-among countries. Trend over the last five years has been declining based on degree-day corrected data.

# Electricity Consumption per Floor Area in Wholesales and Trade in 2000-2019/2020



Electricity consumption per floor area in Finland is in the mid-range among other countries. Level has been declining over the last five years.

# Electricity Consumption per Employee in Wholesales and Trade in 2000-2019



This is a commonly used indicator as better data is often missing. The question is, does this measure energy efficiency at all? Digitalization, overall reduction of staff etc. have their impact on electricity consumption.

## Questions for further discussions:

- What makes a good indicator?
- What are consequences for using bad indicators?
- Should we accept the use of "bad" indicators due to lacking data?
- Service sector, do you agree for using energy/electricity per floor area, if not what would be better?

# Thank you!

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