

Comparison of International Energy Intensities across the G7 and other parts of Europe, including Ukraine

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Consistent data are critical for comparisons of energy consumption across diverse nations. This document uses estimates done by EIA for the energy intensity of Ukraine, the representatives of the Group of Seven (G7), and other parts of Europe. Values are provided for the national economy, the industrial sector, and a small selection of industries. Some of the key drivers for the results are: the natural resources and landscape, the nation's approach to efficiency, the age of the capital stock, the bundle of products being produced, and production processes and technologies. This paper compares energy intensity in 2011 and suggests possible explanations for country differences for possible future research topics. This is not intended to be an exhaustive inter-country analysis of energy use and provides a contrast to other country intensity analysis¹ because the estimates are nominal values for a single year using market exchange rates for GDP.

Background

During analysis of nations around the globe, it is often valuable to evaluate energy consumption and, more specifically, the intensity of such consumption. The common confusion regarding intensity is due to concepts of efficiency and conservation. For clarity:

- Energy intensity is defined as “a ratio of energy consumption to another metric, typically national gross domestic product in the case of a country's energy intensity. Sector-specific intensities may refer to energy consumption per household, per unit of commercial floorspace, per dollar value industrial shipment, or another metric indicative of a sector. Improvements in energy intensity include energy efficiency and conservation as well as structural factors not related to technology or behavior”;
- Energy efficiency is defined as “a ratio of service provided to energy input (e.g., lumens to watts in the case of light bulbs). Services provided can include buildings-sector end uses such as lighting, refrigeration, and heating; industrial processes; or vehicle transportation. Unlike conservation, which involves some reduction of service, energy efficiency provides energy reductions without sacrifice of service. It may also refer to the use of technology to reduce the energy needed for a given purpose or service”; and
- Energy conservation is defined as “a reduction in energy consumption that corresponds with a reduction in service demand. Service demand can include buildings-sector end uses such as lighting, refrigeration, and heating; industrial processes; or vehicle transportation. Unlike energy efficiency, which is typically a technological measure, conservation is better associated with behavior. Examples of conservation include adjusting the thermostat to reduce the output of a heating unit, using occupancy sensors that turn off lights or appliances, and car-pooling.”

The easiest way to estimate the overall behavioral, economic, and technological change is to evaluate intensity. However, common measures of energy intensity will not distinguish separate energy efficiency and energy conservation impacts listed above. An area of particular interest of late is Ukraine and more specifically how it compares to the G7 nations (Canada, France, Germany, Italy, Japan, the United Kingdom and the United States, with representation from the EU) and other parts of Europe.

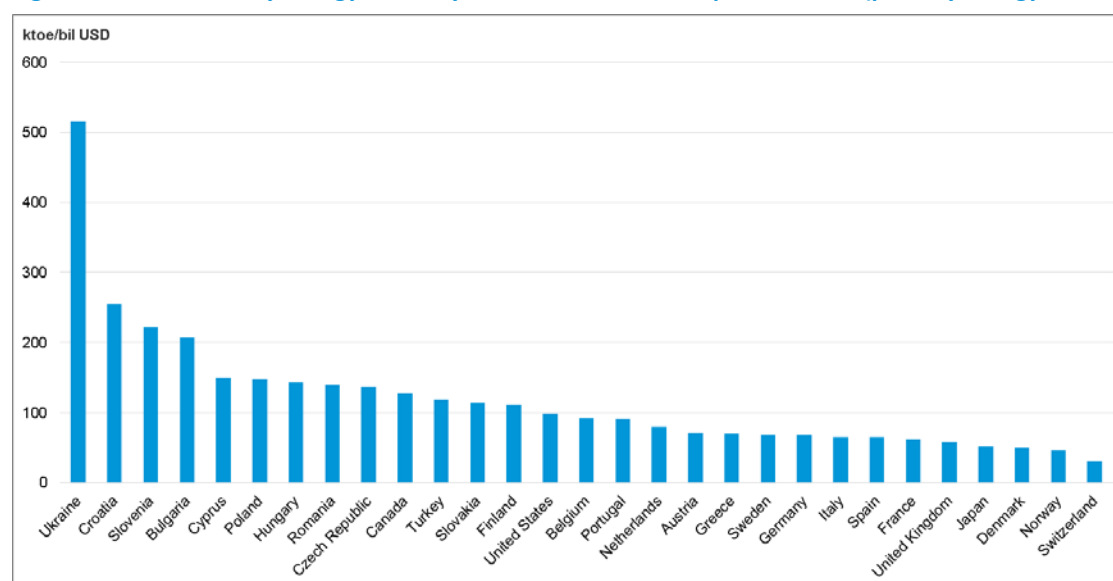
¹ US EIA *International Energy Statistics* <http://www.eia.gov/cfapps/ipdbproject/IEDIndex3.cfm?tid=92&pid=46&aid=2>

This paper will not provide a full explanation of the “why?” for much of what is presented, but instead simply serves a first step of presenting a harmonized estimate of how the nations presented compare across the economy, for the industrial sector, and for select industries.

Total economy and the industrial sector

As seen in Figure 1, Ukraine clearly stands out against the rest of Europe, but perhaps not surprisingly many of the countries showing the highest European energy intensity are located in Eastern Europe and were former communist allies of the Soviet Union, with Cyprus being a notable exception. Canada also falls just within the top 10, which is likely a result of the nation’s large physical size, natural resource industries, and cold climate. Each estimate includes the consumption of all energy sources as reported by IEA divided by gross domestic product as reported by IHS or Eurostat for the year 2011². The corresponding data for Figure 1 can be found in Appendix Table A.

Figure 1. Total economy energy intensity for G7 and select European nations (primary energy consumption/GDP)

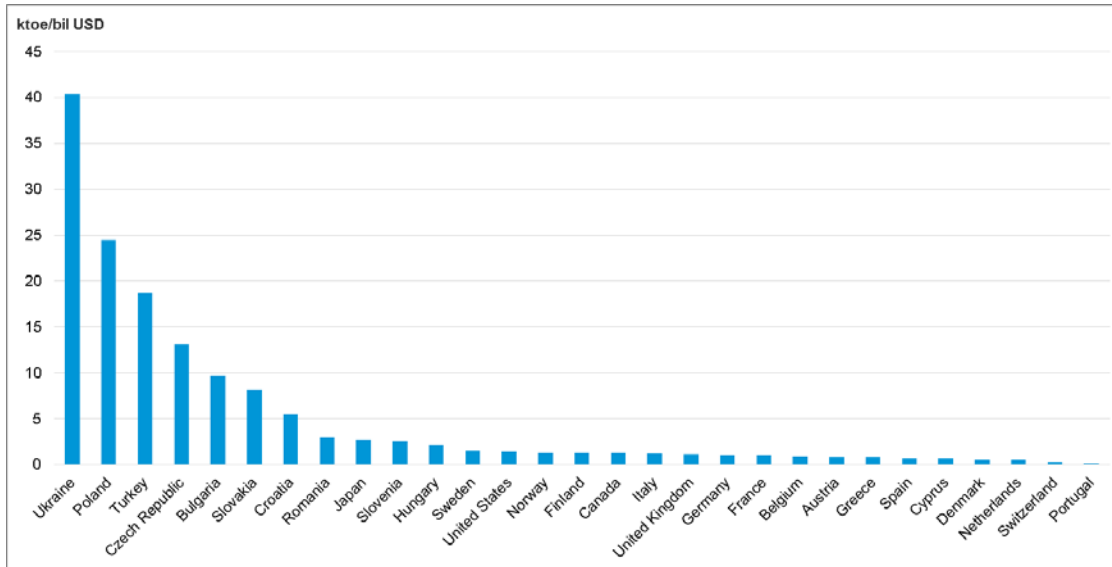


Sources: IEA, IHS, Eurostat; end-use sector demand

The total economy intensity for select fuels can be seen in Figures 2 through 5, where many of the countries in the top 10 most intensive are those whose overall energy intensity is high in Figure 1. Ukraine is still the most intensive for coal and natural gas, but notably Turkey is the third most intensive in coal. Petroleum is primarily a transportation fuel (Figure 4), so it is perhaps not surprising to see some changes in the ranks, with the United States and Portugal falling in the top 10. Renewable energy intensity (Figure 5) is certainly strongly related to available sources, and includes Sweden and Portugal in the top 10, whereas they are not highly intensive overall (Figure 1). Each estimate includes the consumption of the given energy source as reported by IEA divided by gross domestic product as reported by IHS or Eurostat for the year 2011². The data for these figures is also found in Appendix Table A.

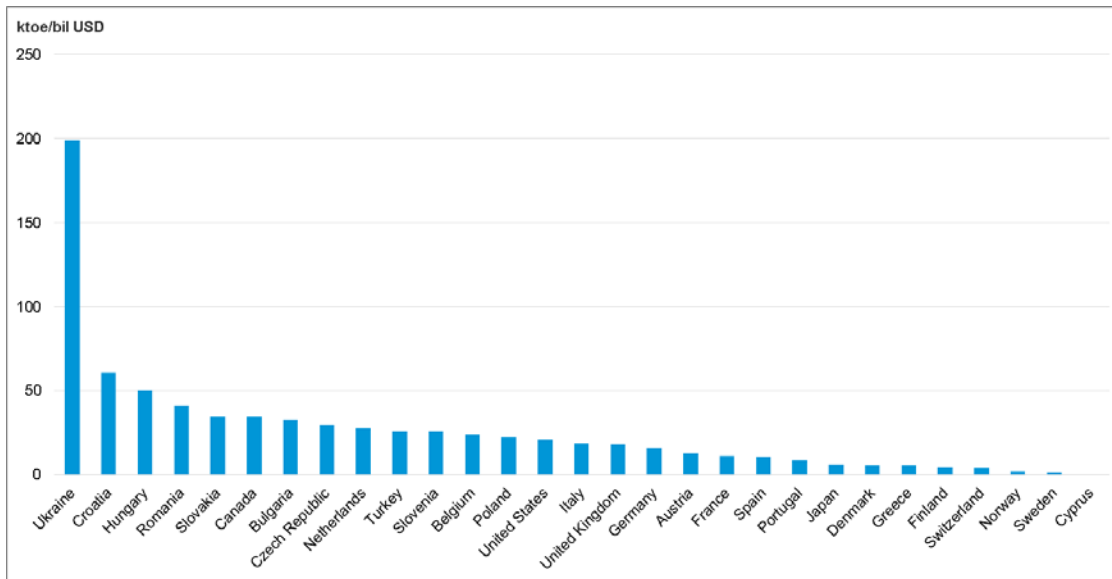
² values in Euros were converted to U.S. dollars using the 2011 average exchange rate

Figure 2. Total economy coal and coke intensity for G7 and select European nations (primary coal and coal-derived product consumption/GDP)



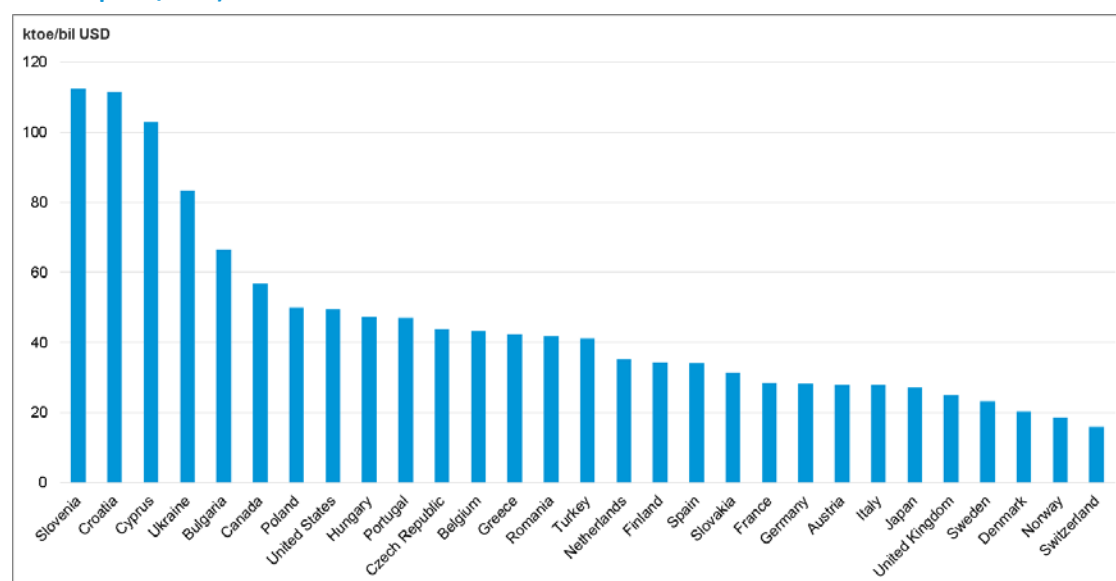
Sources: IEA, IHS, Eurostat; end-use sector demand

Figure 3. Total economy natural gas intensity for G7 and select European nations (primary dry natural gas consumption/GDP)



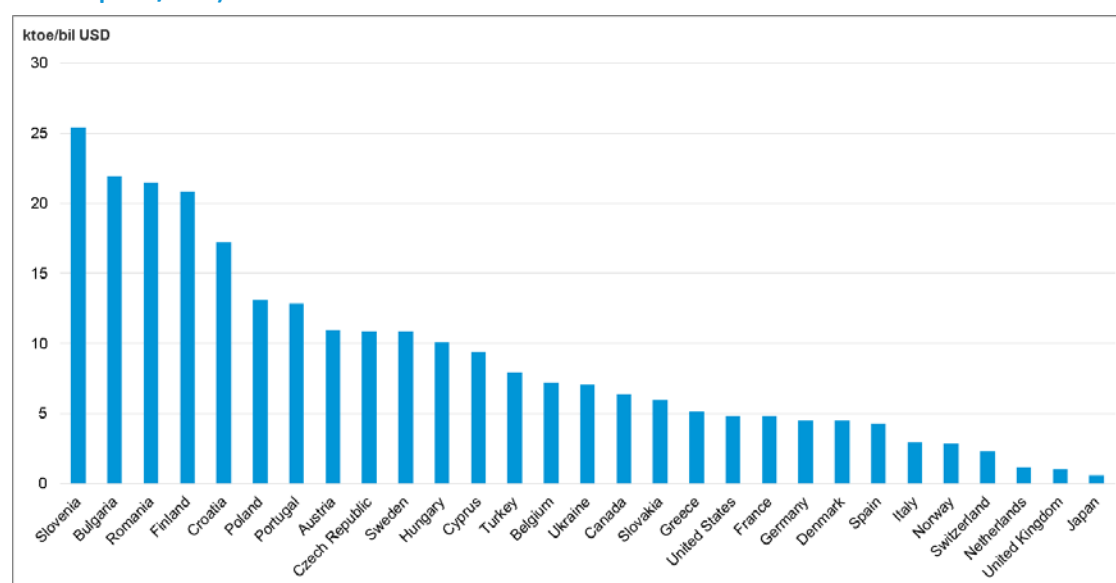
Sources: IEA, IHS, Eurostat; end-use sector demand

Figure 4. Total economy petroleum intensity for G7 and select European nations (oil and oil-derived product consumption/GDP)



Sources: IEA, IHS, Eurostat; end-use sector demand

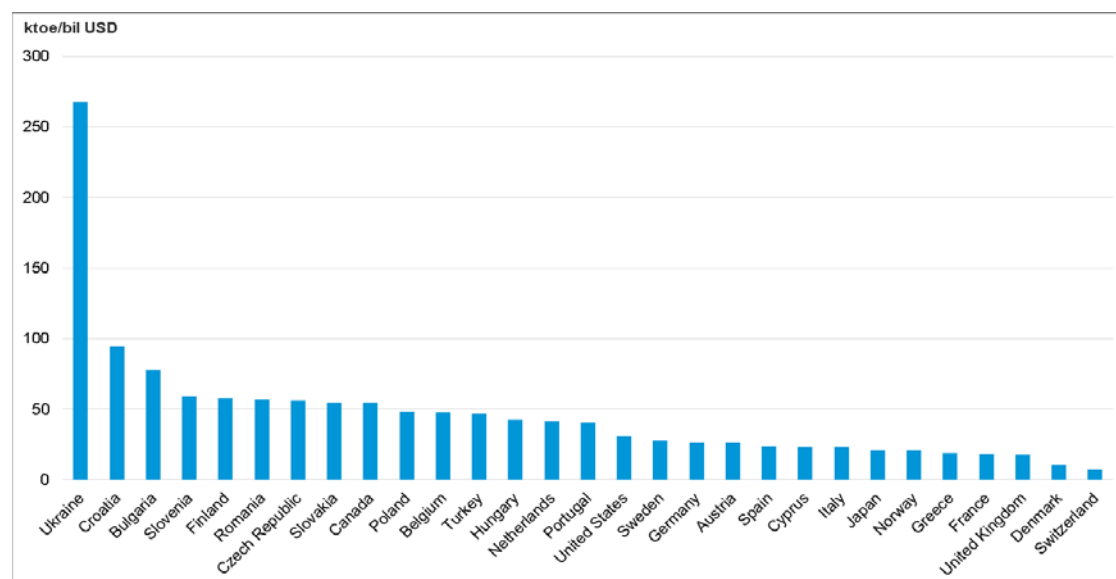
Figure 5. Total economy renewable energy intensity for G7 and select European nations (renewable energy consumption/GDP)



Sources: IEA, IHS, Eurostat; end-use sector demand

Industrial sector energy intensity is shown in Figure 6, showing that the most intensive countries are the same as those most intensive in overall economy, except for some change in the order. Further detail underlying the sector is presented in the next section. Each estimate includes the consumption of the given energy source as reported by IEA divided by gross domestic product as reported by IHS or Eurostat for the year 2011². The data for this figure is found in Appendix Table B.

Figure 6. Industrial sector energy intensity for G7 and select European nations (primary energy consumption/GDP)



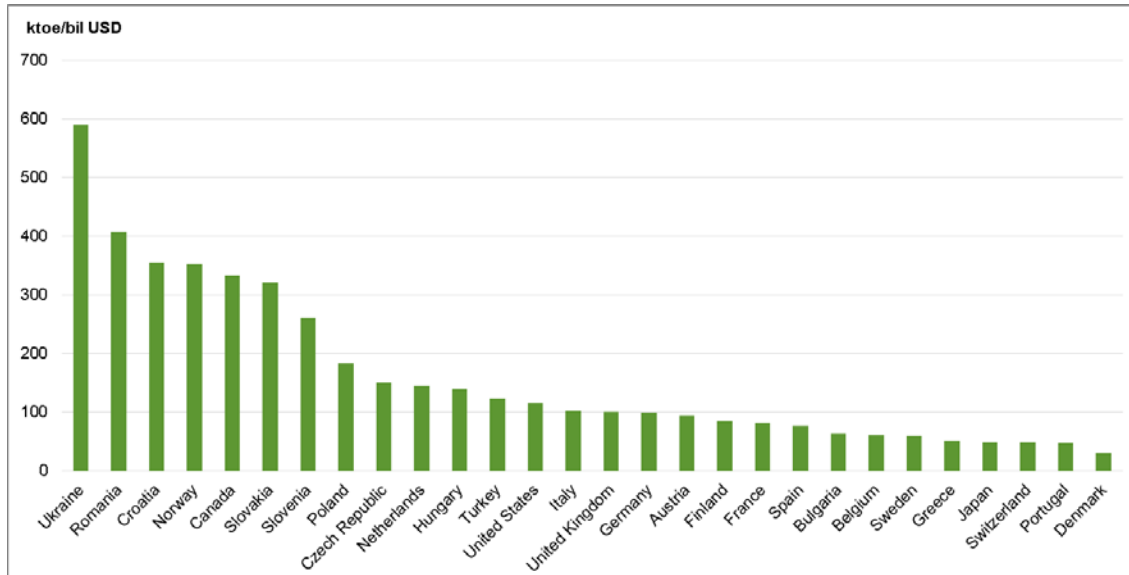
Sources: IEA, IHS, Eurostat

Select industries

The intensities of various energy-intensive³ and important national industries are shown for the countries analyzed in Figures 7 through 13. Each estimate includes the consumption of all energy sources as reported by IEA divided by the gross output of the industry as reported by IHS or Eurostat for the year 2011². The corresponding data for each of the figures in this document can be found in Appendix Tables C through I.

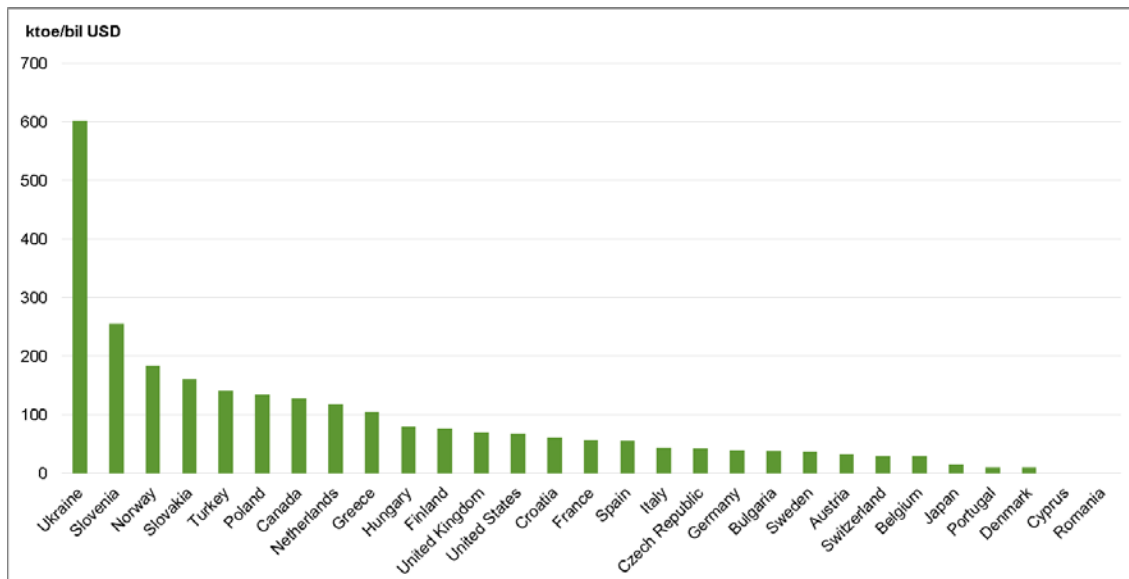
³ Energy-intensive industries traditionally include food manufacturing, pulp and paper, chemical, petroleum refining, iron and steel, aluminum, glass and cement.

Figure 7. Iron and steel industry energy intensity for G7 and select European nations (primary energy consumption/industry output)



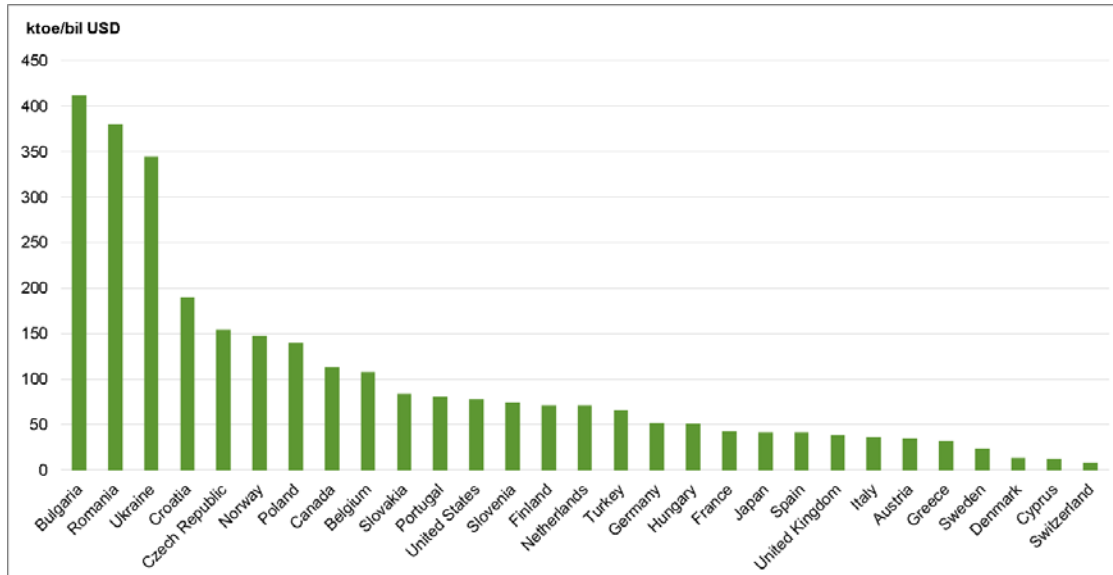
Sources: IEA, IHS, Eurostat

Figure 8. Primary metals industry, other than iron and steel, energy intensity for G7 and select European nations (primary energy consumption/industry output)



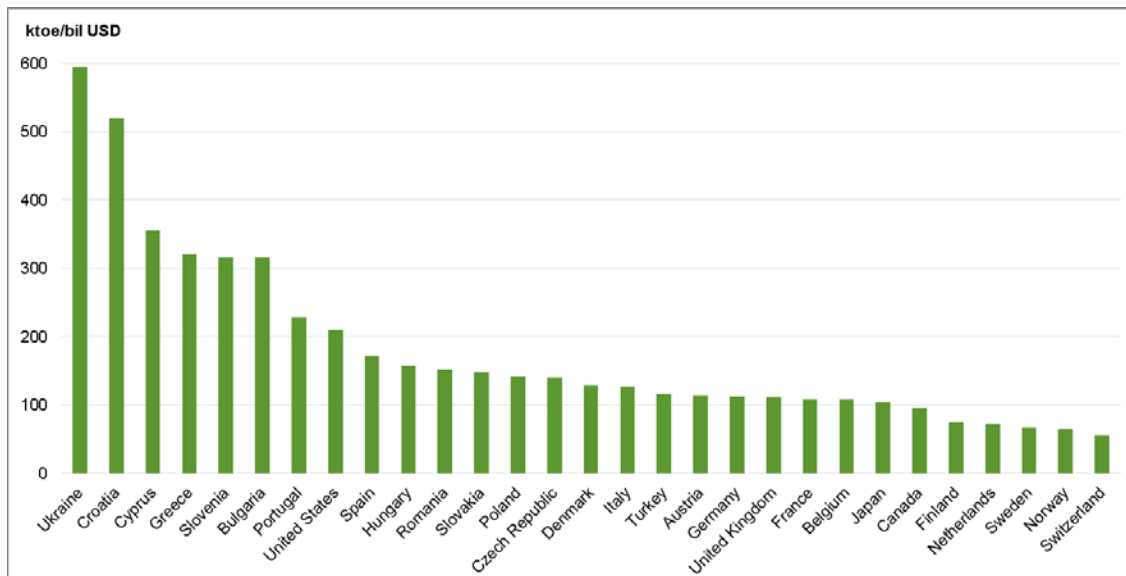
Sources: IEA, IHS, Eurostat

Figure 9. Chemicals industry energy intensity for G7 and select European nations (primary energy consumption/industry output)



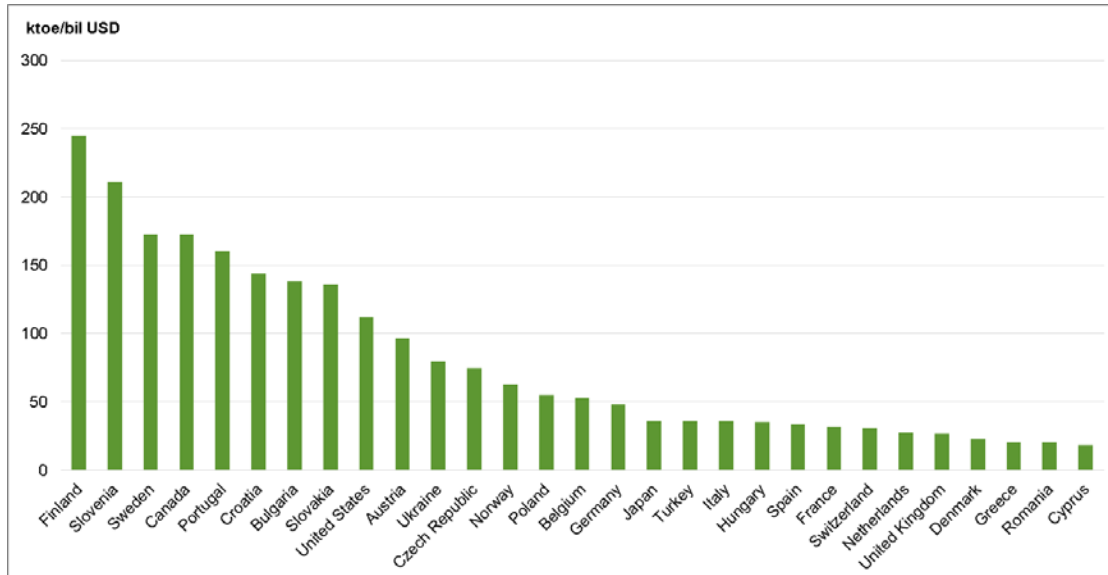
Sources: IEA, IHS, Eurostat

Figure 10. Non-metallic minerals industry energy intensity for G7 and select European nations (primary energy consumption/industry output)



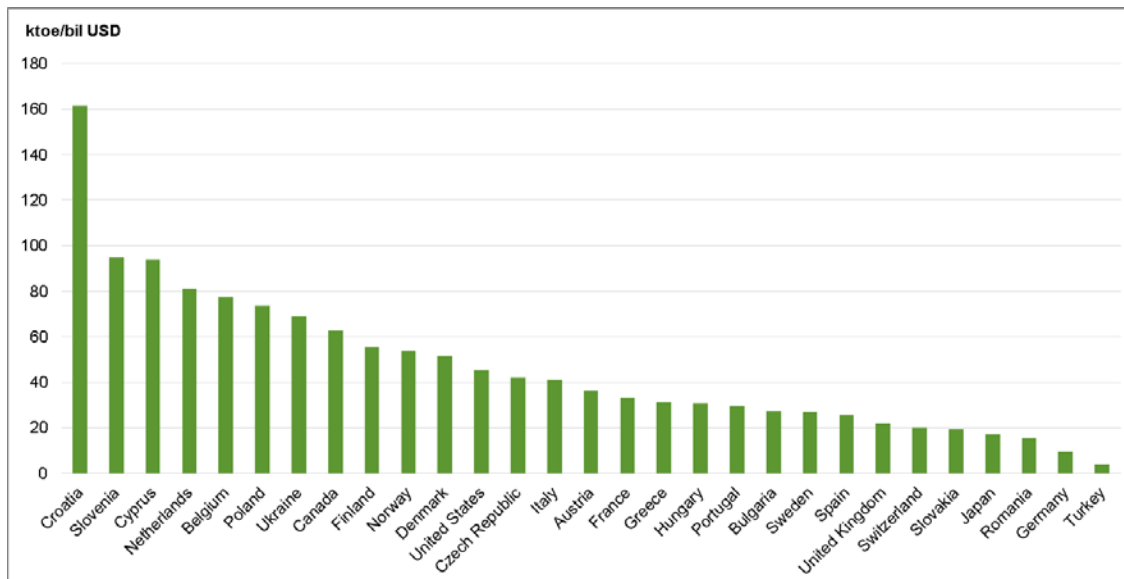
Sources: IEA, IHS, Eurostat

Figure 11. Pulp and paper industry energy intensity for G7 and select European nations (primary energy consumption/industry output)



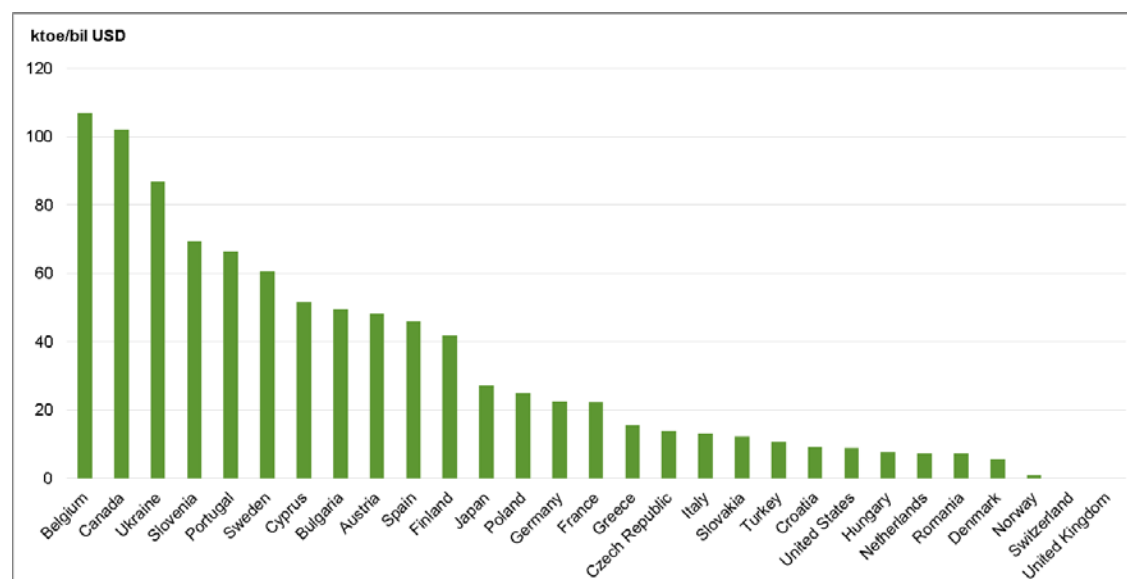
Sources: IEA, IHS, Eurostat

Figure 12. Agriculture industry energy intensity for G7 and select European nations (primary energy consumption/industry output)



Sources: IEA, IHS, Eurostat

Figure 13. Mining industry energy intensity for G7 and select European nations (primary energy consumption/industry output)



Sources: IEA, IHS, Eurostat

Perhaps it is not surprising that many of the countries with the highest energy intensities in the various industries are also those with the highest coal intensities. It is important to note the role of product type, production technology, capacity vintage, and general approach to efficiency (of all kinds, not just energy efficiency) in every country given that these are, in fact, the most likely explanation for many of the results here.

Iron and steel: Many of the lowest-intensity countries in Figure 3 share the common aspect of using larger amounts of fuels other than electricity and/or coal and coke, but this fuel selection may also be an artifact of product type, production technology, capacity vintage, and general approach to efficiency.

Other primary metals: Many of the industries with the highest energy intensity in primary metals other than iron and steel (Figure 4) are the same as those with the most energy-intensive iron and steel industry (Figure 3), which certainly points to factors other than fuel selection. Again, the types of non-iron-based products being made, the way they are made (technology, often determined by the age of capacity), and the general approach to energy efficiency are the most common characteristics amongst the highest intensity countries for these primary metal industries.

Chemicals: Given the extremely diverse set of products and processes included in the chemicals industry there do not appear to be any important patterns in the cross-country energy intensity results of Figure 5.

Non-metallic minerals: Cyprus, Greece, and Spain are in the top 10 most intensive nations for the non-metallic minerals industry (Figure 6) that are not frequently amongst other industries' highest intensity nations. Given that this industry tends not to be export-focused, providing building materials such as cement, it is easy to imagine that countries with building styles of a special nature (e.g. stucco

construction, tile roofing, etc.) would be subject to local demand and/or production techniques, which could lead to unusual energy consumption characteristics.

Paper: Some countries, both intensive and less so for the paper industry (Figure 7), are using large amounts of renewable fuel (Figure 5), primarily pulp and paper production byproducts. The availability and cost of these plant-based fuels may explain why countries that might otherwise emphasize efficiency or utilize energy-saving technologies in general do not have the same motives for doing so in this industry.

Agriculture: Terrain and output type (primarily foodstuffs) are some of the strongest determinants of the energy-intensity of a country's agriculture (Figure 8). Whether it is a nation focused on animal agriculture rather than just crops, or elevations and rocky soil that require additional effort to yield crops, these are often not flexible because they are based on natural constraints or local traditions.

Mining: A broad type of products and geological features are included in the mining industry, which matters a great deal in determining the intensity for each nation (Figure 9). Oil and gas production is very different than coal, which is fairly different from other solid mineral and metal mining. While there is some room for technology/efficiency across countries due to motor efficiency gains, the type of fuel used would mostly remain the same, primarily oil-based liquid fuels.

Conclusion

Through the estimates provided here, EIA offers a first step toward comparison of energy consumption across the representatives of the G7 and other parts of Europe, including Ukraine, by providing consistently calculated energy intensity across all economic activity and for varying levels of disaggregation in the industrial sector. The results indicate that in addition to fuel selection, technology, behavior, and natural circumstances have a strong impact on a nation's energy intensity.

Further work: In addition to further research into causality of these results, estimates using other economic elements would be of value when doing cross-country comparison. It is understood the choice of using market exchange rates rather than PPP can understate the value of local goods and services and limit proper comparison across countries. It is also recognized there is value in calculating gross output estimates rather than value added concepts for total economic activity.

Appendix

Table A. Total economy energy intensity (primary energy consumption/GDP) for G7 and select European nations (kiloton oil equivalent per billion US dollar in 2011)

Country	Coal/coke	Other	Natural gas	Oil, derived, & liquids	Nuclear	Renewables	Electricity	Heat	Total of all energy sources
Europe									
Austria	0.83	0.37	12.58	27.88	0.00	11.00	14.10	4.65	71.41
Belgium	0.88	0.70	23.64	43.36	0.00	7.20	14.88	1.43	92.11
Bulgaria	9.66	1.12	32.92	66.55	0.00	21.94	52.72	22.43	207.36
Croatia	5.48	0.11	60.41	111.64	0.00	17.24	51.15	9.00	255.08
Cyprus	0.63	0.00	0.00	103.00	0.00	9.40	36.68	0.09	149.80
Czech Republic	13.11	2.29	29.93	43.91	0.00	10.88	25.68	11.06	136.86
Denmark	0.50	0.05	5.51	20.41	0.00	4.52	9.41	8.72	49.12
Finland	1.31	1.89	4.43	34.25	0.00	20.85	30.48	18.03	111.26
France	1.01	0.29	11.23	28.41	0.00	4.80	14.68	1.49	61.91
Germany	1.06	1.46	15.69	28.19	0.00	4.53	13.75	3.08	67.76
Greece	0.81	0.00	5.45	42.41	0.00	5.13	16.53	0.20	70.52
Hungary	2.11	1.29	50.11	47.25	0.00	10.11	24.00	8.17	143.03
Italy	1.21	0.00	18.60	27.74	0.00	2.95	13.43	1.65	65.59
Netherlands	0.47	0.62	27.57	35.17	0.00	1.16	12.43	2.78	80.21
Norway	1.31	0.08	1.94	18.65	0.00	2.86	20.68	0.76	46.30
Poland	24.47	1.21	22.39	49.96	0.00	13.12	22.67	13.87	147.69
Portugal	0.10	0.00	8.22	47.00	0.00	12.87	20.81	1.67	90.66
Romania	3.04	0.88	40.94	41.74	0.00	21.45	21.43	9.69	139.17
Slovakia	8.14	4.23	34.62	31.30	0.00	5.97	22.29	8.01	114.56
Slovenia	2.51	0.00	25.68	112.34	0.00	25.42	47.76	8.41	222.09
Spain	0.68	0.23	10.77	34.20	0.00	4.28	15.23	0.00	65.39
Sweden	1.52	0.34	1.39	23.31	0.00	10.85	22.43	8.65	68.49
Switzerland	0.23	0.00	3.93	15.99	0.00	2.29	8.05	0.61	31.10
Turkey	18.62	0.44	25.72	41.10	0.00	7.93	23.01	1.77	118.60
United Kingdom	1.09	0.08	17.77	24.82	0.00	1.03	12.54	0.58	57.90
Ukraine	40.35	23.68	198.78	83.41	0.00	7.08	81.88	81.39	516.56
Non-European G7									
Canada	1.26	0.66	34.62	56.78	0.00	6.37	27.40	0.36	127.44
Japan	2.72	1.61	5.77	27.23	0.00	0.58	13.23	0.09	51.23
United States	1.47	0.16	20.67	49.57	0.00	4.81	21.55	0.44	98.66

Sources: IEA, IHS, Eurostat

Table B. Industrial sector energy intensity (primary energy consumption/GDP) for G7 and select European nations (kiloton oil equivalent per billion US dollar in 2011)

Country	Coal/coke	Other	Natural gas	Oil, derived, & liquids	Renewables	Electricity	Heat	Total of all energy sources
Europe								
Austria	0.73	0.33	7.20	6.57	4.48	6.35	0.63	26.30
Belgium	0.67	0.69	12.44	19.13	5.79	7.43	1.43	47.58
Bulgaria	5.44	0.00	24.38	15.77	4.12	16.46	11.28	77.44
Croatia	5.26	0.00	36.26	37.01	1.81	12.10	1.81	94.21
Cyprus	0.63	0.00	0.00	17.71	0.63	4.07	0.09	23.31
Czech Republic	10.63	1.88	12.15	14.06	2.76	10.62	4.04	56.15
Denmark	0.40	0.00	2.47	3.81	0.66	2.67	0.47	10.49
Finland	1.29	1.67	5.47	13.03	13.64	15.52	7.26	57.87
France	0.87	0.29	4.22	7.91	0.80	4.24	0.00	18.32
Germany	0.74	1.31	6.77	8.83	1.15	6.26	1.28	26.33
Greece	0.78	0.00	3.49	8.67	0.97	5.04	0.00	18.95
Hungary	0.74	1.24	13.10	16.19	0.98	7.29	2.82	42.34
Italy	1.12	0.00	5.18	8.61	0.24	5.96	1.84	22.95
Netherlands	0.45	0.62	11.30	22.00	0.12	4.87	2.07	41.44
Norway	1.31	0.08	1.70	7.52	1.09	8.80	0.25	20.74
Poland	8.09	1.20	12.25	11.03	3.42	8.46	3.93	48.39
Portugal	0.10	0.00	6.39	16.71	7.38	7.53	2.37	40.48
Romania	2.93	0.83	24.32	14.04	1.41	11.08	2.05	56.65
Slovakia	4.36	4.22	14.93	14.93	4.01	10.65	1.28	54.37
Slovenia	2.51	0.00	18.94	9.47	3.52	22.20	2.56	59.26
Spain	0.55	0.23	5.99	10.88	0.93	4.79	0.00	23.37
Sweden	1.52	0.32	0.93	7.44	6.95	9.85	0.80	27.81
Switzerland	0.21	0.00	1.31	2.23	0.72	2.64	0.24	7.36
Turkey	9.66	0.44	13.42	10.45	0.00	10.88	1.77	46.63
United Kingdom	0.79	0.08	4.85	7.20	0.21	4.21	0.43	17.77
Ukraine	36.12	33.70	82.41	18.39	0.31	52.99	43.93	267.85
Non-European G7								
Canada	1.25	0.66	17.74	19.39	3.83	11.08	0.36	54.30
Japan	2.64	1.61	1.46	10.81	0.49	4.20	0.00	21.20
United States	1.38	0.16	8.67	13.11	2.12	5.12	0.46	31.03

Sources: IEA, IHS, Eurostat

Table C. Iron and steel energy intensity (primary energy consumption/GDP) for G7 and select European nations (kiloton oil equivalent per billion US dollar in 2011)

Country	Coal/coke	Other	Natural gas	Oil, derived, & liquids	Renewables	Electricity	Heat	Total of all energy sources
Europe								
Austria	10.04	11.11	38.66	0.71	1.69	30.75	1.60	94.47
Belgium	0.00	14.79	25.25	0.58	0.00	20.82	0.00	61.44
Bulgaria	4.34	0.00	27.31	0.00	0.00	32.51	0.00	64.16
Croatia	21.56	0.00	172.50	0.00	0.00	161.72	0.00	355.79
Cyprus	na	na	na	na	na	na	na	na
Czech Republic	63.34	31.27	23.70	1.34	0.00	23.16	7.31	150.20
Denmark	0.00	0.00	17.26	0.96	0.00	10.55	1.92	30.69
Finland	16.76	13.43	4.86	17.90	0.00	26.76	5.62	85.32
France	24.14	17.31	16.41	0.97	0.00	23.05	0.00	81.86
Germany	14.28	27.28	26.79	3.12	0.03	27.75	0.62	99.88
Greece	0.00	0.00	17.62	0.28	0.00	34.10	0.00	52.00
Hungary	20.32	72.78	17.01	0.00	0.00	21.27	7.56	138.95
Italy	36.84	0.00	26.79	1.55	0.00	36.27	0.88	102.32
Netherlands	4.60	65.80	40.37	0.43	0.00	33.33	0.00	144.68
Norway	116.30	7.85	0.49	6.87	3.93	217.88	0.00	352.82
Poland	26.19	48.43	40.56	0.30	0.49	53.55	13.88	183.30
Portugal	1.16	0.00	13.10	0.58	0.00	32.32	0.00	47.17
Romania	90.84	35.68	129.56	0.76	0.76	147.02	3.29	407.91
Slovakia	74.40	127.36	54.85	0.00	0.95	63.36	0.00	320.60
Slovenia	10.87	0.00	123.21	5.44	0.00	114.15	7.25	260.91
Spain	10.15	9.83	8.52	9.19	0.00	38.79	0.00	76.45
Sweden	22.01	8.01	1.57	15.85	0.00	12.25	0.00	59.69
Switzerland	2.34	0.00	15.08	1.70	0.64	28.68	0.00	48.22
Turkey	45.92	8.06	19.82	3.97	0.00	45.68	0.00	123.45
United Kingdom	37.60	10.56	30.31	0.27	0.00	22.48	0.00	101.28
Ukraine	131.17	140.90	172.43	9.11	0.00	86.79	50.23	590.64
Non-European G7								
Canada	40.85	88.08	140.29	0.00	0.25	63.39	0.00	332.77
Japan	8.51	18.18	4.64	4.02	0.08	13.74	0.00	49.16
United States	20.21	10.23	50.37	5.88	0.00	27.13	1.25	115.08

Sources: IEA, IHS, Eurostat

Table D. Primary metals industry, other than iron and steel, energy intensity (primary energy consumption/GDP) for G7 and select European nations (kiloton oil equivalent per billion US dollar in 2011)

Country	Coal/coke	Other	Natural gas	Oil, derived, & liquids	Renewables	Electricity	Heat	Total of all energy sources
Europe								
Austria	0.54	0.00	16.55	0.72	0.00	14.57	0.18	32.38
Belgium	0.00	0.00	12.55	0.09	1.92	13.95	0.00	28.51
Bulgaria	0.00	0.00	6.01	7.06	0.00	21.43	3.14	37.63
Croatia	0.00	0.00	4.64	23.19	0.00	32.46	0.00	60.29
Cyprus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Czech Republic	2.79	0.00	25.81	0.00	0.00	13.25	0.70	42.55
Denmark	0.00	0.00	1.58	0.00	0.00	6.31	1.58	9.46
Finland	1.52	0.00	0.25	8.11	5.58	42.35	18.76	77.08
France	0.17	0.00	19.63	1.27	0.00	35.67	0.00	56.69
Germany	0.39	0.16	14.70	1.45	0.14	22.28	0.29	39.43
Greece	21.99	0.00	9.98	15.60	0.00	57.24	0.00	104.97
Hungary	0.00	0.00	38.98	0.00	0.00	17.80	22.13	79.40
Italy	0.46	0.00	22.46	1.87	0.00	18.13	0.05	43.01
Netherlands	0.00	0.00	14.59	0.00	0.00	98.41	5.61	118.62
Norway	0.00	0.00	7.69	3.42	0.00	172.44	0.11	183.66
Poland	34.83	0.24	37.93	1.91	5.73	39.84	14.31	134.79
Portugal	0.00	0.00	2.97	0.74	2.60	3.72	0.00	10.03
Romania	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Slovakia	1.95	0.00	20.84	0.00	0.00	137.44	0.00	160.88
Slovenia	1.85	0.00	40.72	20.36	0.00	190.65	0.00	255.43
Spain	2.74	0.00	15.39	4.18	0.04	32.79	0.00	55.15
Sweden	4.14	0.00	0.83	4.14	0.00	27.59	0.00	36.69
Switzerland	0.00	0.00	12.58	1.05	0.00	15.73	0.00	29.36
Turkey	28.94	0.00	76.95	0.00	0.00	35.02	0.00	140.91
United Kingdom	1.16	0.00	17.22	1.82	0.00	49.67	0.00	69.78
Ukraine	21.62	0.00	189.60	6.36	0.00	131.70	253.52	602.81
Non-European G7								
Canada	7.06	0.00	13.40	0.00	0.00	107.10	0.00	127.59
Japan	1.64	0.16	0.43	1.97	0.12	11.68	0.00	16.01
United States	0.00	0.00	22.93	3.12	0.00	40.45	0.69	67.20

Sources: IEA, IHS, Eurostat

Table E. Chemicals energy intensity (primary energy consumption/GDP) for G7 and select European nations (kiloton oil equivalent per billion US dollar in 2011)

Country	Coal/coke	Other	Natural gas	Oil, derived, & liquids	Renewables	Electricity	Heat	Total of all energy sources
Europe								
Austria	0.04	0.00	9.96	1.13	7.85	13.36	2.03	34.40
Belgium	0.00	0.00	46.53	0.14	34.00	19.36	7.34	107.36
Bulgaria	42.95	0.00	133.98	3.27	0.00	40.15	190.93	411.27
Croatia	0.00	0.00	135.33	5.56	0.00	32.44	16.68	190.02
Cyprus	0.00	0.00	0.00	0.00	0.00	12.54	0.00	12.54
Czech Republic	72.57	0.00	24.89	1.20	0.40	31.21	23.99	154.26
Denmark	0.00	0.00	5.36	0.69	0.00	6.62	1.13	13.87
Finland	0.00	0.00	1.34	17.34	0.63	31.92	20.02	71.41
France	1.75	0.00	7.81	16.20	0.00	16.31	0.00	42.07
Germany	1.05	1.05	20.59	0.00	1.40	18.66	8.81	51.54
Greece	0.00	0.00	8.26	16.33	0.00	7.34	0.00	31.93
Hungary	0.10	0.00	15.83	0.10	0.00	20.27	14.42	50.71
Italy	0.03	0.00	8.43	6.00	0.00	11.80	10.30	36.57
Netherlands	0.00	0.00	21.96	27.07	0.01	13.03	9.02	71.09
Norway	20.59	1.77	9.05	43.88	2.50	68.52	1.14	147.53
Poland	45.00	0.56	12.68	18.12	6.60	26.39	30.31	139.65
Portugal	1.62	0.00	23.52	8.11	5.81	27.85	13.79	80.85
Romania	21.83	0.00	217.46	49.29	3.58	56.80	31.55	380.52
Slovakia	0.00	0.00	33.08	10.51	3.85	20.26	16.16	84.12
Slovenia	0.00	0.00	24.51	3.36	6.73	26.91	13.93	74.96
Spain	2.50	0.00	22.96	6.53	0.07	9.62	0.00	41.68
Sweden	0.00	0.28	3.16	3.76	0.32	16.17	0.00	23.73
Switzerland	0.00	0.00	2.73	0.65	0.89	3.87	0.59	8.73
Turkey	8.28	0.00	35.46	10.88	0.00	11.40	0.00	66.01
United Kingdom	0.43	0.00	19.11	0.90	0.00	13.78	3.84	38.08
Ukraine	6.68	2.67	58.09	22.40	0.14	64.84	189.70	344.53
Non-European G7								
Canada	0.00	0.00	76.42	0.00	0.00	31.88	4.45	112.74
Japan	6.54	1.27	3.04	19.66	0.13	11.26	0.00	41.91
United States	5.59	0.00	41.20	11.58	0.29	14.98	4.53	78.17

Sources: IEA, IHS, Eurostat

Table F. Non-metallic minerals energy intensity (primary energy consumption/GDP) for G7 and select European nations (kiloton oil equivalent per billion US dollar in 2011)

Country	Coal/coke	Other	Natural gas	Oil, derived, & liquids	Renewables	Electricity	Heat	Total of all energy sources
Europe								
Austria	9.31	0.00	34.54	9.63	43.54	16.95	0.10	113.97
Belgium	20.36	0.17	26.49	17.29	22.06	21.72	0.00	108.08
Bulgaria	61.58	0.00	139.18	65.28	9.85	40.03	0.00	315.92
Croatia	176.91	0.00	142.43	121.44	7.50	70.46	0.00	520.23
Cyprus	20.73	0.00	0.00	269.52	20.73	38.50	0.00	355.41
Czech Republic	23.61	0.28	66.78	2.93	18.16	26.41	2.10	140.28
Denmark	18.87	0.00	27.28	51.08	9.58	18.29	3.19	128.29
Finland	19.93	0.00	10.78	22.04	0.47	17.11	3.52	74.56
France	12.14	0.00	41.66	23.60	9.41	21.45	0.00	108.26
Germany	6.50	17.43	42.71	9.31	17.28	18.95	0.26	112.47
Greece	29.10	0.00	22.93	220.46	7.94	40.56	0.00	320.55
Hungary	14.91	0.00	57.04	24.98	27.59	30.20	1.49	156.96
Italy	7.65	0.00	46.35	44.82	4.23	21.52	1.83	126.38
Netherlands	3.88	0.00	52.78	2.74	0.00	12.54	0.00	72.04
Norway	19.72	1.13	2.72	16.55	8.61	15.87	0.23	64.83
Poland	41.82	2.12	50.01	4.94	20.70	19.62	1.83	140.99
Portugal	0.62	0.00	71.52	64.11	64.57	26.57	1.54	228.77
Romania	3.15	0.00	63.98	35.82	10.36	37.17	1.58	152.07
Slovakia	44.62	0.00	63.21	11.15	0.37	25.66	3.35	147.98
Slovenia	35.75	0.00	137.89	47.67	37.45	56.18	0.00	316.64
Spain	6.15	0.00	47.25	86.55	7.20	24.34	0.00	171.49
Sweden	28.55	0.00	11.30	13.90	0.00	13.28	0.00	67.19
Switzerland	15.01	0.00	6.45	7.69	14.14	12.53	0.00	55.68
Turkey	0.00	0.00	50.95	17.19	0.00	47.96	0.00	116.10
United Kingdom	27.28	0.00	52.94	5.64	0.00	25.58	0.00	111.40
Ukraine	242.29	0.38	218.54	22.73	6.17	78.49	26.83	595.43
Non-European G7								
Canada	41.82	0.00	3.38	29.77	8.89	11.98	0.00	95.84
Japan	44.14	2.46	5.69	20.94	5.16	25.28	0.00	103.67
United States	52.84	0.00	76.90	49.18	4.73	26.67	0.04	210.36

Sources: IEA, IHS, Eurostat

Table G. Pulp and paper energy intensity (primary energy consumption/GDP) for G7 and select European nations (kiloton oil equivalent per billion US dollar in 2011)

Country	Coal/coke	Other	Natural gas	Oil, derived, & liquids	Renewables	Electricity	Heat	Total of all energy sources
Europe								
Austria	2.83	0.00	26.07	0.94	37.72	27.82	1.28	96.65
Belgium	1.32	0.00	8.14	0.79	23.42	15.02	4.17	52.86
Bulgaria	0.00	0.00	22.13	6.32	89.17	18.34	2.53	138.49
Croatia	0.00	0.00	74.57	14.91	6.63	46.40	1.66	144.17
Cyprus	0.00	0.00	0.00	0.00	0.00	18.02	0.00	18.02
Czech Republic	8.69	0.00	13.17	0.87	32.54	16.77	2.48	74.39
Denmark	0.00	0.00	5.60	0.78	7.47	7.62	1.24	22.71
Finland	0.20	8.09	19.44	5.94	116.15	68.54	26.38	244.69
France	0.33	0.00	10.11	1.17	7.91	12.09	0.00	31.62
Germany	1.74	0.90	16.59	0.64	6.67	16.42	5.13	48.08
Greece	0.00	0.00	7.10	5.55	0.00	7.77	0.00	20.41
Hungary	0.00	0.00	14.45	0.44	1.78	10.90	7.34	34.91
Italy	0.00	0.00	12.50	0.70	0.00	13.09	9.34	35.63
Netherlands	0.00	0.00	12.91	0.04	0.12	8.33	5.70	27.14
Norway	0.00	0.00	0.24	4.94	26.07	31.57	0.00	62.82
Poland	11.67	0.00	4.80	2.07	19.90	13.34	2.95	54.76
Portugal	0.00	0.00	13.78	4.06	99.15	32.48	10.83	160.29
Romania	0.00	0.00	8.05	0.00	0.60	11.33	0.30	20.28
Slovakia	0.00	0.00	22.59	1.91	83.56	23.68	4.35	136.09
Slovenia	29.79	0.00	99.31	3.72	9.93	68.27	1.24	211.03
Spain	0.00	0.00	12.62	4.21	9.09	7.57	0.00	33.47
Sweden	0.10	0.03	0.36	8.41	95.98	67.83	0.00	172.71
Switzerland	0.00	0.00	8.73	1.39	3.74	14.23	2.35	30.43
Turkey	5.28	0.00	10.47	1.67	0.00	18.25	0.00	35.67
United Kingdom	0.89	0.00	14.27	0.41	0.00	11.34	0.01	26.94
Ukraine	0.14	0.00	7.06	2.51	0.05	26.33	43.47	79.56
Non-European G7								
Canada	0.00	0.00	23.55	3.97	95.03	49.57	0.53	172.64
Japan	6.77	0.00	2.10	3.59	11.69	11.80	0.00	35.95
United States	9.42	0.00	19.44	8.41	58.59	14.70	1.24	111.80

Sources: IEA, IHS, Eurostat

Table H. Agriculture energy intensity (primary energy consumption/GDP) for G7 and select European nations (kiloton oil equivalent per billion US dollar in 2011)

Country	Coal/coke	Other	Natural gas	Oil, derived, & liquids	Renewables	Electricity	Heat	Total of all energy sources
Europe								
Austria	0.07	0.00	0.87	16.05	13.79	4.66	0.60	36.11
Belgium	0.00	0.00	35.36	35.93	3.12	2.55	0.38	77.34
Bulgaria	0.39	0.13	3.92	17.62	0.52	3.13	1.31	27.15
Croatia	0.00	0.00	11.25	145.60	0.00	3.97	0.66	161.48
Cyprus	0.00	0.00	0.00	57.17	9.15	27.44	0.00	93.76
Czech Republic	0.76	0.00	4.11	25.37	3.96	6.93	0.91	42.06
Denmark	1.83	0.00	2.15	31.42	3.41	10.03	2.40	51.23
Finland	0.32	3.38	0.32	33.25	11.35	6.68	0.00	55.30
France	0.00	0.00	1.42	29.20	0.39	2.21	0.00	33.21
Germany	0.00	0.00	0.00	0.00	0.00	9.49	0.00	9.49
Greece	0.00	0.00	0.00	19.30	1.76	9.98	0.00	31.04
Hungary	0.06	0.00	7.86	16.98	1.71	4.18	0.00	30.85
Italy	0.00	0.00	1.83	31.36	0.69	7.15	0.13	41.17
Netherlands	0.00	0.00	50.61	9.88	1.92	15.81	2.81	81.03
Norway	0.00	0.00	0.94	40.45	0.27	12.10	0.00	53.82
Poland	21.19	0.00	0.75	37.03	11.55	2.77	0.42	73.72
Portugal	0.00	0.00	0.34	23.16	0.00	5.84	0.00	29.21
Romania	0.00	0.28	1.99	9.69	0.18	2.31	0.85	15.29
Slovakia	0.12	0.00	4.86	8.47	2.49	3.24	0.37	19.56
Slovenia	0.00	0.00	0.00	84.59	9.11	0.00	0.00	95.00
Spain	0.00	0.00	1.66	18.54	0.90	4.31	0.00	25.43
Sweden	0.00	0.00	1.37	10.97	8.46	5.89	0.40	27.09
Switzerland	0.00	0.00	12.12	0.00	1.34	6.69	0.00	20.22
Turkey	0.00	0.00	0.04	3.51	0.00	0.32	0.00	3.86
United Kingdom	0.02	0.00	3.34	6.69	3.72	8.06	0.00	21.84
Ukraine	0.49	0.00	5.42	42.69	0.48	9.44	10.30	68.82
Non-European G7								
Canada	0.00	0.00	9.53	42.60	0.00	10.69	0.00	62.80
Japan	0.00	0.00	0.00	16.09	0.38	0.37	0.00	16.85
United States	0.00	0.00	3.11	34.20	0.82	7.00	0.00	45.12

Sources: IEA, IHS, Eurostat

Table I. Mining energy intensity (primary energy consumption/GDP) for G7 and select European nations (kiloton oil equivalent per billion US dollar in 2011)

Country	Coal/coke	Other	Natural gas	Oil, derived, & liquids	Renewables	Electricity	Heat	Total of all energy sources
Europe								
Austria	0.00	0.00	15.25	3.29	0.30	29.31	0.00	48.14
Belgium	0.00	0.00	81.92	0.00	0.00	24.37	0.00	106.96
Bulgaria	0.00	0.00	0.00	4.51	0.00	45.13	0.00	49.64
Croatia	0.00	0.00	1.40	6.31	0.00	1.40	0.00	9.11
Cyprus	0.00	0.00	0.00	0.00	0.00	51.58	0.00	51.58
Czech Republic	0.39	0.00	7.77	0.97	0.19	4.27	0.19	13.78
Denmark	0.25	0.00	1.07	1.90	1.90	0.50	0.08	5.62
Finland	0.00	0.00	0.00	10.69	0.00	29.15	1.62	41.79
France	0.00	0.00	6.21	11.23	0.00	4.93	0.00	22.28
Germany	0.24	3.45	6.37	2.08	0.36	9.71	0.42	22.57
Greece	0.00	0.00	0.00	13.70	0.00	1.83	0.00	15.53
Hungary	0.00	0.00	2.54	0.00	0.00	6.35	0.00	7.62
Italy	0.00	0.00	4.88	2.67	0.00	5.64	0.00	13.26
Netherlands	0.12	0.00	2.84	0.12	0.00	0.95	3.14	7.16
Norway	0.00	0.00	0.03	0.48	0.00	0.36	0.00	0.86
Poland	0.64	0.00	2.24	4.87	0.00	12.23	4.87	24.91
Portugal	0.00	0.00	7.01	21.52	0.00	25.02	13.51	66.56
Romania	0.00	0.00	0.28	3.77	0.00	2.94	0.00	7.13
Slovakia	0.00	0.00	2.23	5.57	0.00	4.46	0.00	12.26
Slovenia	0.00	0.00	5.33	21.33	0.00	42.66	0.00	69.33
Spain	0.00	0.00	11.73	14.89	0.00	18.99	0.00	45.79
Sweden	14.28	1.25	0.00	9.84	0.00	35.34	0.00	60.57
Switzerland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Turkey	0.00	0.00	5.96	0.00	0.00	4.71	0.00	10.67
United Kingdom	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ukraine	0.93	0.06	19.38	16.33	0.00	44.98	5.05	86.74
Non-European G7								
Canada	0.66	0.00	65.66	20.27	0.00	15.55	0.00	102.13
Japan	0.43	0.00	10.49	9.72	0.00	6.48	0.00	27.11
United States	0.00	0.00	3.34	0.00	0.00	5.45	0.00	8.79

Sources: IEA, IHS, Eurostat