European Commission

Tracking EU Citizens' Interest in EC Priorities Using Online Search Data

The European Green Deal

Joint Research Centre

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Tracking EU Citizens' Interest in EC Priorities Using Online Search Data

The European Green Deal

Contents

Highlights

• The European Green Deal is the most ambitious and challenging goal set by the European Commission. Aiming to make the European Union, the world's second-largest economy, climate-neutral by 2050, the European Green Deal will transform EU societies and industries.

• To support the European Commission in this effort, the JRC created a set of indicators to monitor EU citizens' interest in topics related to the European Green Deal both over time and across Member States and their regions.

• Using web searches, the JRC created two sets of indicators drawing from the six policy areas indicated by the European Commission. The first set of indicators captures online search data related to citizens' *behaviour* in the context of the European Green Deal, such as their searches related to mobility, energy, waste and nutrition. The second set of indicators captures online search data on citizens' *awareness*, such as those about pollution, clean energy, ecosystems and climate.

• Over the last five years, interest in **green mobility** has been slowly but steadily increasing. This is particularly true for individual and public transport. In 2020, the trend was heavily affected by the sanitary crisis. Google searches for public transport and shared mobility dramatically decreased without recovering to pre-pandemic levels.

• The increase in searches related to **vegetarian and vegan food** reflects the growing popularity of these dietary choices. Indeed, European average meat consumption, which now stands at about 69 kilograms per capita per year, is expected to fall by a kilogram over the next ten years according to the EU agricultural outlook.

• In 2020, confinement measures due to the pandemic caused a huge drop in energy demand and delayed new renewable energy sources installations. Despite that, Google searches on **renewable energy sources** reached the highest interest in May this year. Among the topics in sub-dimensions related to clean energy, solar energy is the most-searched one.

• Searches for topics related to **pollution** have been mostly stable over the last few years. The pandemic brought an unexpected positive outcome by increasing the awareness of air pollution and its negative consequences, and early evidence suggests that this effect will not be short-lived.

• Searches related to **climate change** peaked towards the end of 2016. This peak comes shortly after the entry into force of the Paris agreement. Another peak comes during the Global Week of Climate Action and shortly after Greta Thunberg's speech at the United Nations Climate Action Summit on September 23rd 2019.

• **The indicators can be used to obtain causal insights**, both at the regional and national level. For example, searches for low-emission vehicles in Italy surged following the implementation, by regional authorities, of economic incentives to replace old and high-emission cars. Searches for public transport instead dropped during the pandemic, not only as a result of containment measures but also because of self-imposed cautionary measures.

The European Green Deal

On December 11th 2019, the European Commission announced the European Green Deal, a radical project aiming to make the European Union, the world's second-largest economy, climate-neutral by 2050. By that date, the European Union is expected to have no net emissions of greenhouse gases and its economic growth should be decoupled from resource use.

The European Green Deal is a policy initiative that will result in a legislative firestorm centered around nine policy areas which are key to achieve the ambitious goals: biodiversity; from farm to fork; sustainable agriculture; clean energy; sustainable industry; building and renovating; sustainable mobility; eliminating pollution; and climate action.

In this report, the first of a series of reports targeting the European Commission priorities, the European Commission's Joint Research Centre (hereafter JRC) tries to gauge the interest of the European Union citizens around the policy areas composing the European Green Deal. To overcome the lack of EU-wide data on several topics, the JRC uses web searches to proxy the interest of Europeans in eight composite indicators which observe the trends over time and across countries of two thematic areas: citizens' green behaviours and citizens' green awareness. In addition, it will provide evidence at regional level for 23 Member States.[1] Finally, the report shows how the indicators provided can be used to perform causal analysis to assess shifts in the relative volume of web searches following changes in policies related to the Green Deal (i.e., the introduction of new benefits for the purchase of low-emission vehicles) or in the aftermath of the covid-19 pandemic (i.e., searches for public transport).

Each main thematic area is composed of four composite indicators which aggregate several topics made available by Google. Topics are aggregation of web searches performed on the Google Search engine that can be assigned to a particular concept. Starting from January 2015 to the end of November 2020, the JRC collected the weekly relative amount of searches on the queries of interests for all 27 EU Member States and for 467 regions across 23 Member States. This report aims at making Google data accessible using ad hoc visualisations to uncover trends, to compare interests across countries and regions as well as over time.

While there are limitations in exploiting web searches to proxy the interests of Europeans (see the Methodology, p. 29), online search behaviour could provide insights on otherwise hardly measurable topics (such as the awareness of the citizens on a given topic) or topics which coverage and frequency are lower (as in the case of survey data).

The remainder of the report is structured as follows: first, the indicators (and their components) capturing searches related to citizens' behaviour related to the European Green Deal are presented and discussed. Then, it outlines the indicators (and their components) capturing Europeans' awareness about areas linked to the European Green Deal. Finally, it shows how online search data can be used to provide Green Deal-related causal insights. Details about the methodology are available at the end of the report.

1. Countries not included in the regional analysis due to lacking data availability are: Greece, Malta, Portugal and Slovenia.

Behaviour

Mobility

Individual transport
Bicycle
Electric vehicle
Hybrid electric vehicle
Hybrid vehicle
Plug-in hybrid
Electric kick scooter
Electric bicycle

Public transport
Public transport
Bus
Train

Shared mobility
Car pool
Car sharing
Bike sharing

Energy

Energy consumption
European Union energy label
Building insulation
Efficient energy use
Electric energy consumption
LED lamp
Thermal insulation

Energy production
Solar cell panel
Mini wind turbine
Solar panel
Solar water heating

Waste

Waste management
Glass recycling
Paper recycling
Plastic recycling
Recycling
Recycling bin
Waste collection
Waste management
Waste sorting
Electronic waste
Recyclable waste

Waste reduction
Second-hand shop
Biodegradable plastic
Biodegradable waste
Compost
Composting
Reusable shopping bag
Zero waste
Food waste

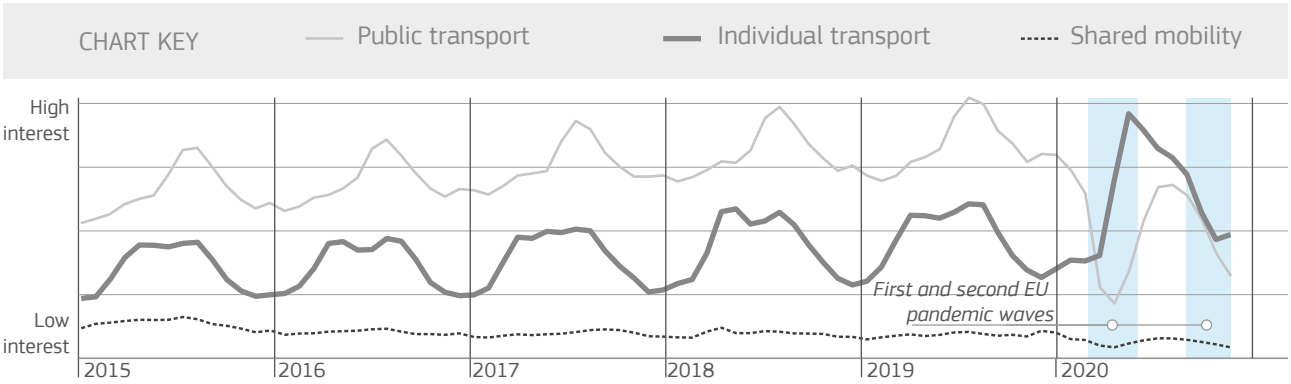
Nutrition

Food consumption
Veganism
Vegetarianism
Water consumption
Water purification

Food production
Farmers' market
Local food
Organic farming
Organic food
European ecolabel
Short food supply chains
Direct selling
Sustainable agriculture

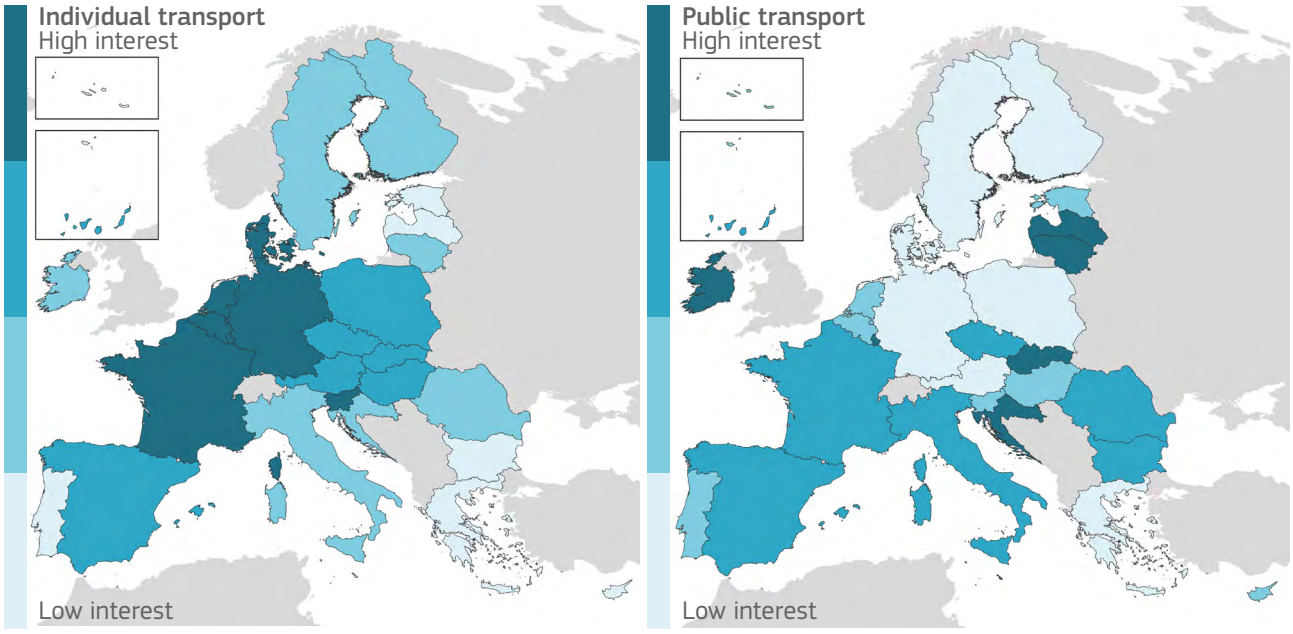
JRC Conceptual framework on citizens' behaviours related to the Green Deal based on Google search data

Mobility



EU-27 average interest in individual and public transport over the last six years (2015-2020).

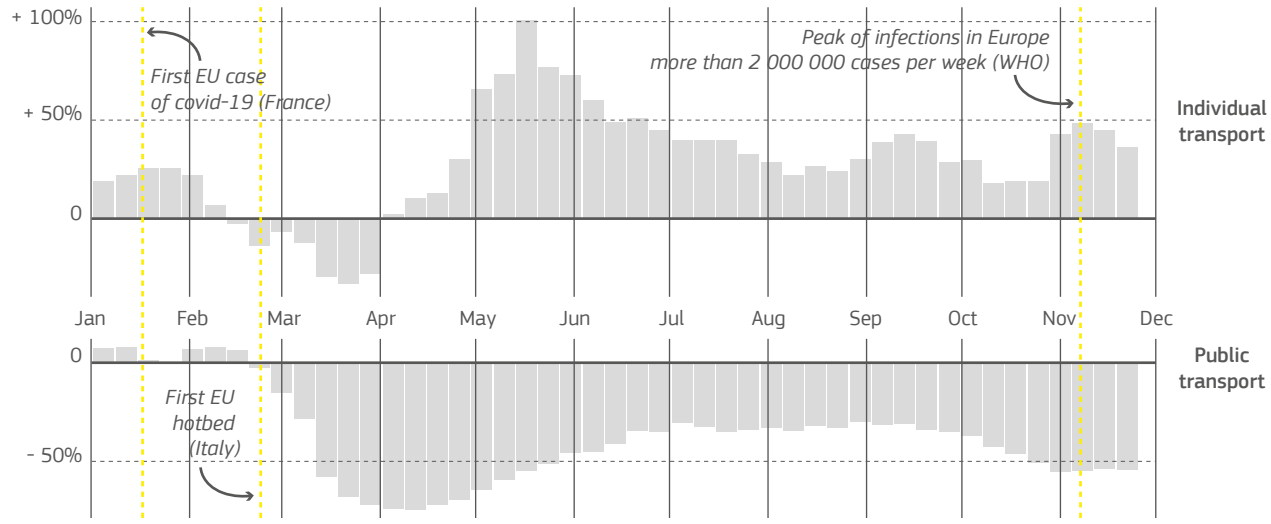
According to the European Environment Agency, transport is one of the main sectors contributing to climate change.[2] Europeans' searches for topics related to green mobility can be a lens to read their interest in the topic. Over the last five years, interest in green mobility has been slowly but steadily increasing. This is particularly true for individual and public transport. In 2020, the trends were heavily affected by the sanitary crisis. Google Searches for public transport (e.g., bus and train) and shared mobility (car-pooling, car and bike sharing) dramatically decreased without recovering to pre-pandemic levels. Conversely, while searches for public transport are generally higher than the ones for individual transport, this trend changed in mid-May, with individual transport searches peaking and remaining higher than the ones for public transport.



Interest in individual transport and public transport in the 27 EU countries (2015-19 average).

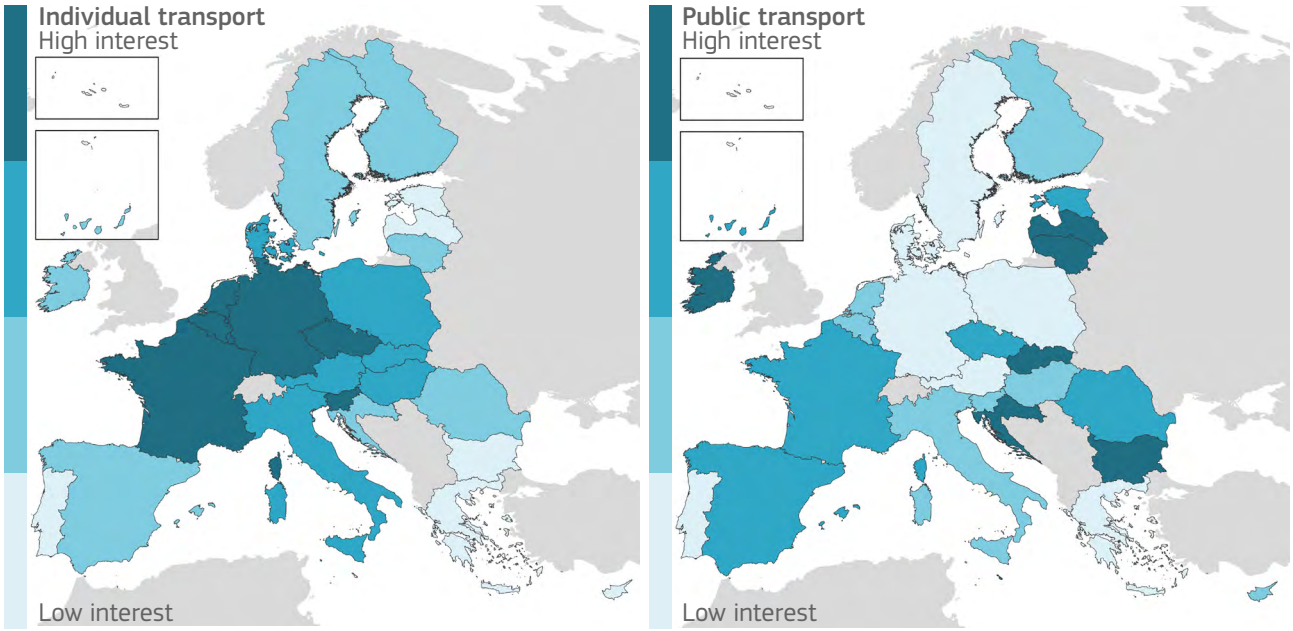
Before the pandemic (between 2015 and 2019), interest in public transport was higher in Mediterranean and Eastern Europe. Countries with the highest proportion of Google searches for train and bus were Croatia, Ireland, Latvia, Lithuania and Slovakia. In Central and some Northern countries (Belgium, Denmark, France, Germany, Luxembourg, Netherlands and Slovenia) interest was higher in individual transport, in particular bicycles and electric mobility.

2. https://www.eea.europa.eu/themes/transport/intro



Difference in interest in individual and public transport between 2020 and 2019.

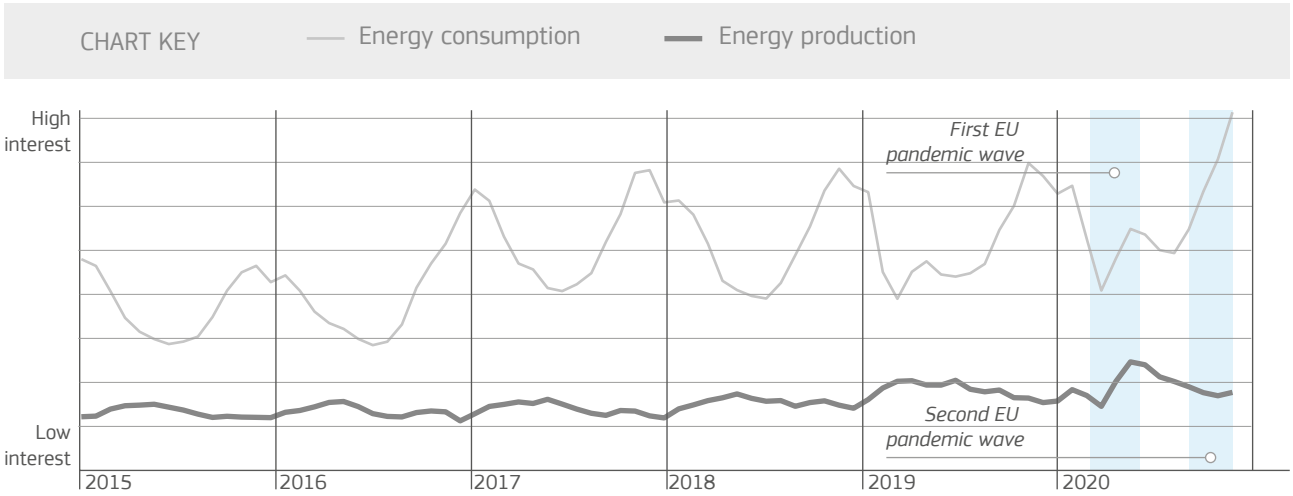
In 2020, interest in green mobility was deeply influenced by movement restrictions imposed to slow the spread of the pandemic. After the first European hotbed, both individual and public transport showed a lower interest compared to the same weeks in 2019. In March 2020, interest in bicycles and electric vehicles (individual transport) was almost half than in 2019, and interest in public transport was almost 70% lower than 2019 at the end of the month. From April on, trends completely changed (in particular for individual transport). In May 2020 interest in green individual mobility was much higher than in May 2019, driven by topics such as bicycle and electric bicycle while the interest in public transport remained lower and did not recover.



Interest in individual and public transport in the 27 EU countries (2020 average).

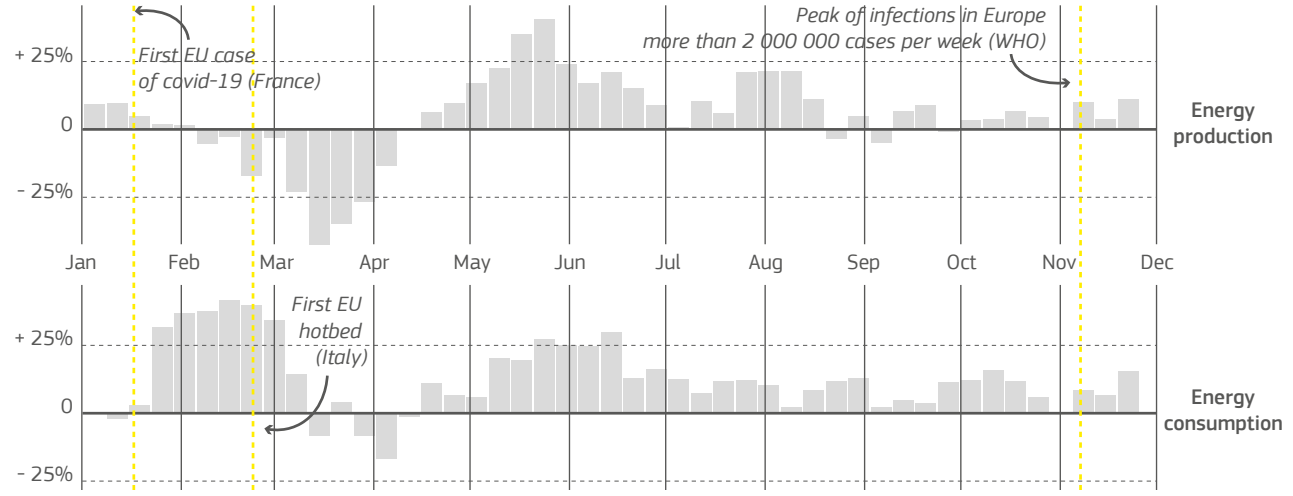
Despite that, the distribution of interest in individual transport remained almost unchanged in the 27 EU countries over the last year. In 2020, as for the period between 2015 and 2019, Central European countries had the highest interest in individual transport. For public transport, over the last year, average interest increased in Bulgaria and Finland, while it decreased in Italy and Luxembourg, but overall changes due to the pandemic were proportional across countries.

Energy



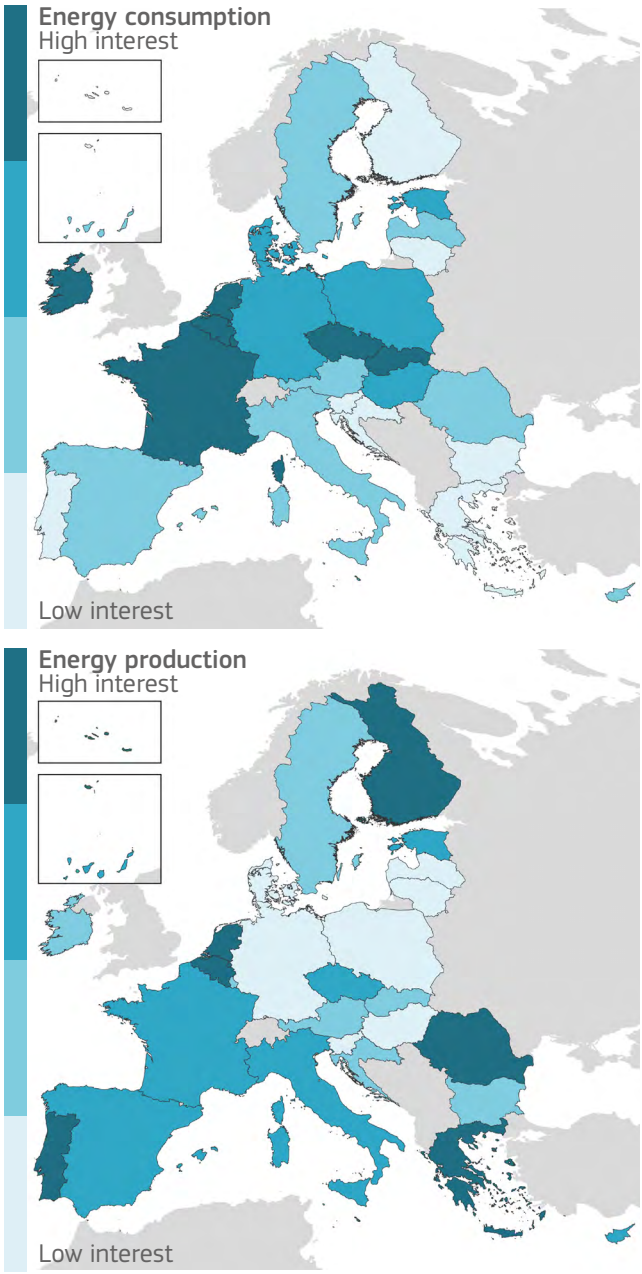
EU-27 average interest in energy production and consumption over the last six years (2015-2020).

The analysis of Europeans' interest in energy are related to renewable domestic energy production methods and energy efficiency interventions (energy consumption). The chart shows that interest in energy has clearly been influenced by the ongoing pandemic. Google searches on energy production grew in EU countries between 2015 and 2019 before abruptly dropping in March 2020 after the first European hotbed. Despite that, it peaked at the end of May maintaining a higher proportion of interest compared with the same period of the past years. Interest in energy consumption had a similar setback in March followed by a quick recovery at the end of May and an all-time high at the end of November. This might be linked to the economic measures implemented by EU Member States to finance energy efficiency interventions to support economic recovery.

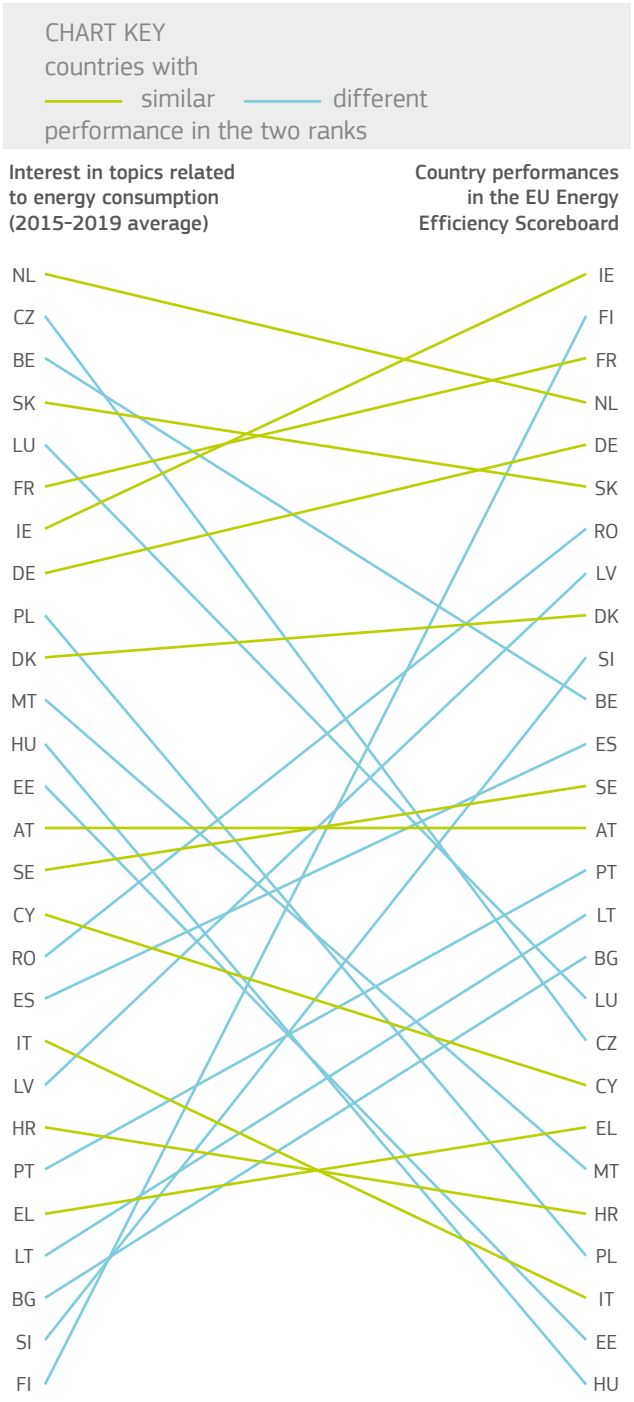


Difference in interest in energy production and consumption between 2020 and 2019.

The effects of the pandemic and related measures are even more evident when comparing the interest in renewable domestic energy production and green energy consumption in 2019 and 2020. Apart from some weeks in March and at the beginning of April, the interest in energy consumption has been higher than in 2019. This was particularly true during the first months of the year. On average, from mid-January to March, interest was 30% higher than in 2019. After a brief setback, it remained higher than the previous year from mid-April on.



Interest in energy consumption and production in the 27 EU countries (2015-2019 average).



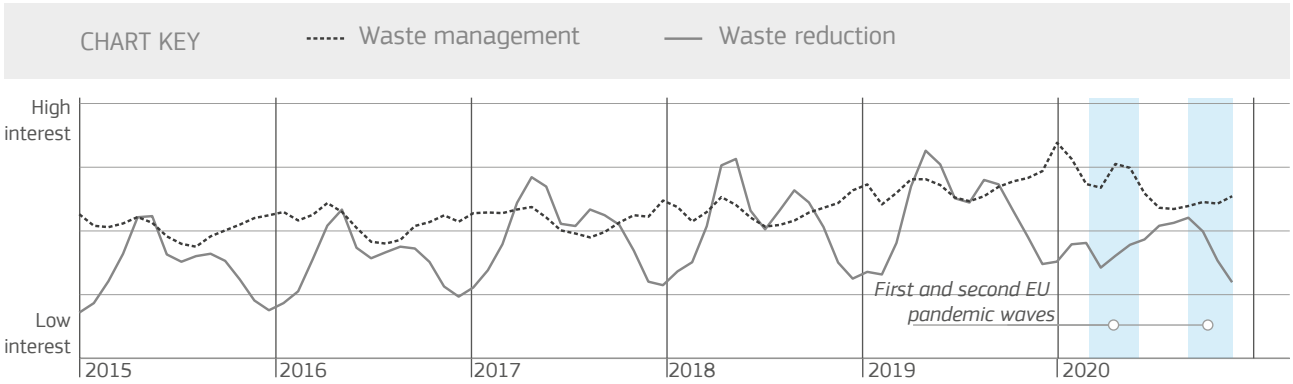
EU Energy Efficiency Scoreboard and interest in energy consumption.

Interest in energy production had a long setback from February to the beginning of April before recovering. Then, until mid-August, it was on average 20% higher than in 2019. During the last months of 2020 Europeans' interest has been in line with that of the previous year.

Before the pandemic (2015-2019), interest in topics related to efficient energy consumption was higher in Central Europe, in particular, in Belgium, Czechia, France, Netherlands and Slovakia. Interestingly, most of these countries are also among the best performers in the EU Energy Efficiency Scoreboard[3], the tool to assess the energy efficiency performance of European Union countries. In the same period, interest in residential power generation (energy production) was higher in Belgium, Finland, Greece, Netherlands, Portugal and Romania.

3. EU Energy Efficiency Scoreboard: *https://www.odyssee-mure.eu/data-tools/scoring-efficiency-countries.html*

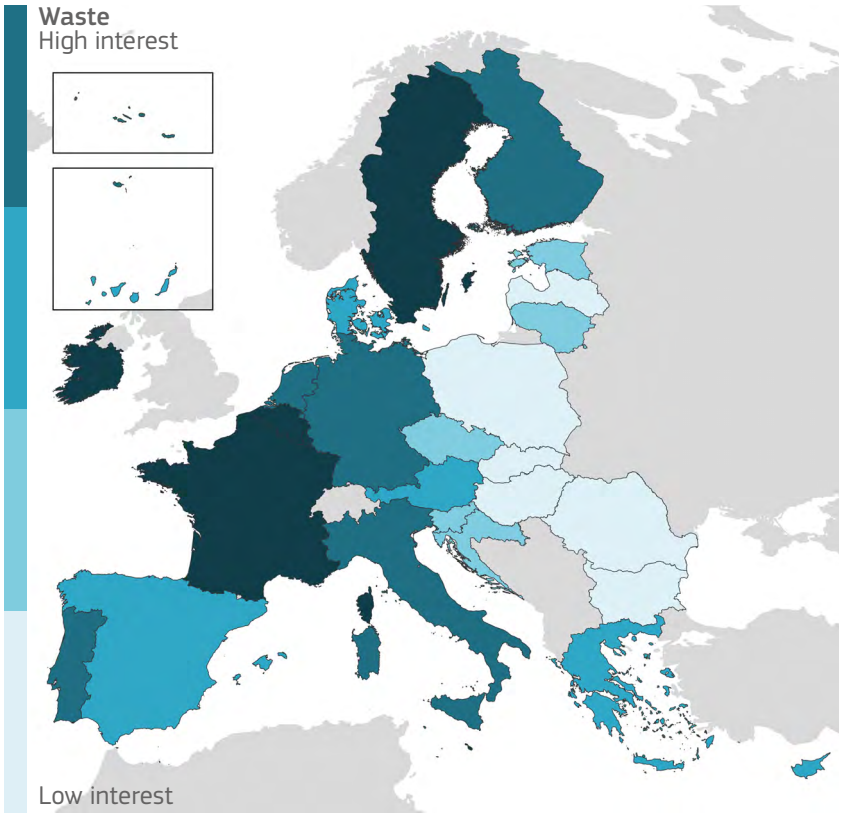
Waste



EU-27 average interest in waste management and reduction over the last six years (2015-2020).

Turning waste into a resource is a priority to a green and circular economy. Although waste management in Europe is steadily improving, Member States still lose a significant amount of potential raw materials such as metals, wood, glass, paper and plastics. In 2018, each EU citizen generated on average 1.8 tonnes per inhabitant of waste (excluding major mineral waste). Of this waste, more than 20% is still landfilled or burned, while Eurostat estimates that about 600 million tons could be reused or recycled.[4]

Between 2015 and 2019, web searches for topics related to waste slowly increased. The European outbreak of the covid-19 pandemic abruptly stopped this trend. The change is particularly visible in waste reduction, which did not start its usual recovery after the winter holidays break, and dropped again during the second European covid-19 wave.



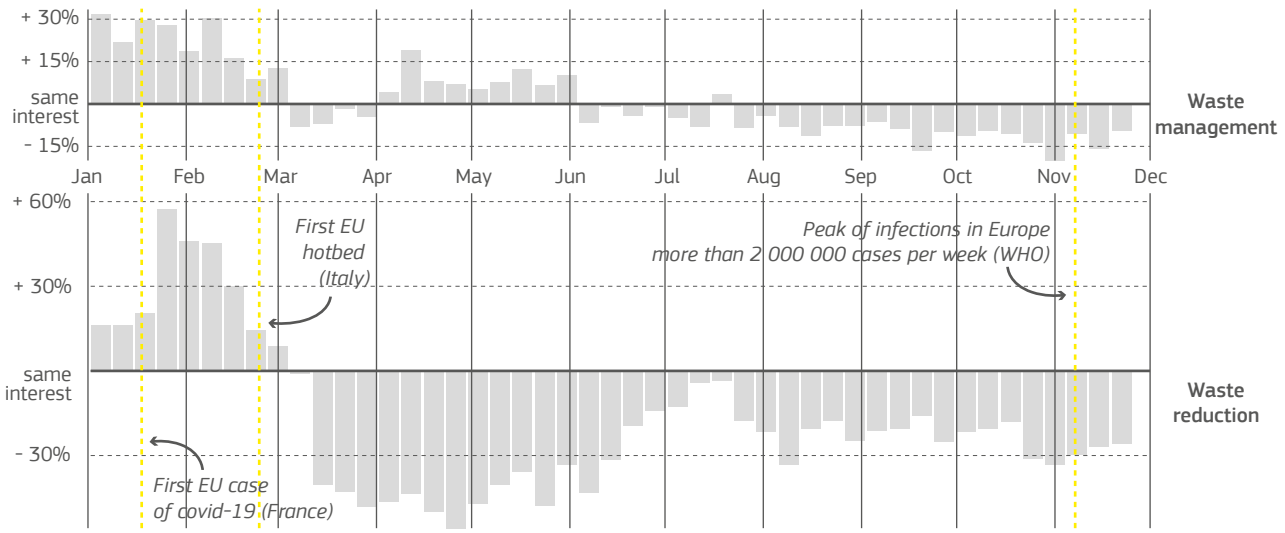
Interest in waste in the 27 EU countries (2015-19 average).

France, Ireland and Belgium have the highest level of interest in topics related to waste in Europe. In particular, France and Ireland have the highest relative interest for composting and compost, while Belgium records the highest European interest for second-hand shops.

In Ireland and Sweden, two of the European countries with the highest interest in topics related to waste, people searched especially for topics related to recycling, while in France the most-searched topic in the domain is second-hand shop.

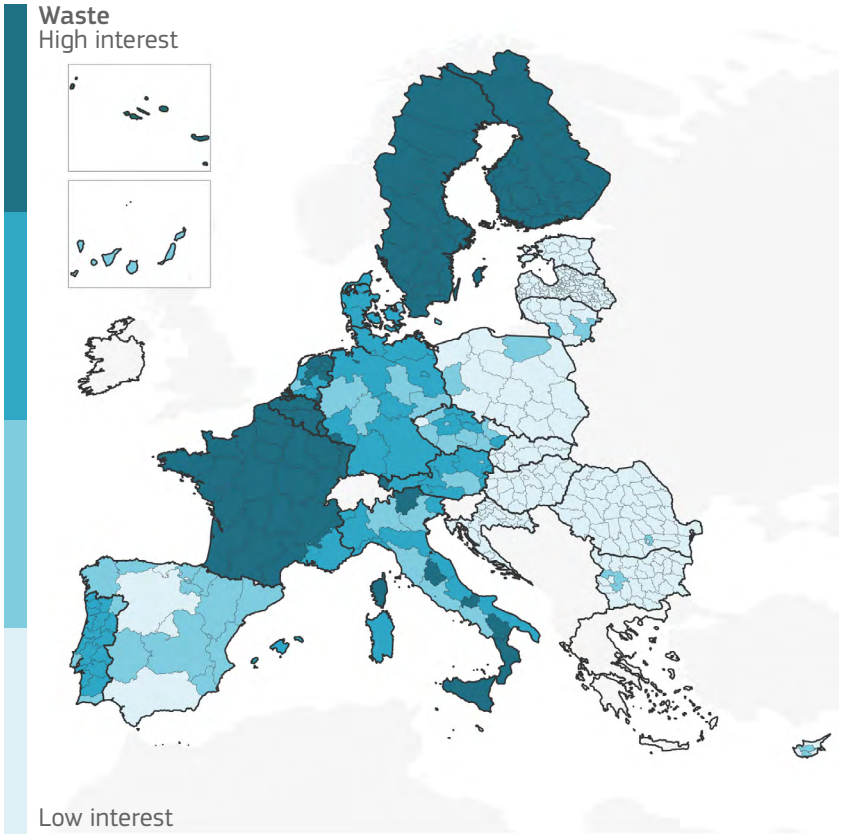
The decrease in the relative interest in topics related to waste reduction is particularly visible when looking at the comparison between 2020 and 2019. Although the year began with

4. Waste statistics are available at https://ec.europa.eu/eurostat/web/waste/overview



Difference in interest waste reduction and waste management between 2020 and 2019.

interest levels higher than 2019, this rapidly changed with the first European covid-19 wave in early March. The interest level increased again during summer, almost reaching 2019 values, but decreased again at the end of summer, and remained lower than 2019 throughout autumn when the second wave of the pandemic hit the EU. Also, the interest in waste reduction has changed over the last year, if compared to 2019. The change though is different from the one observed for waste management: the interest seems to have been lower at the beginning of the first wave of covid-19 in Europe, while it increased to a level higher than that of 2019 in April and May. The interest nevertheless decreased again in summer 2020 and has not shown signs of recovery until November.

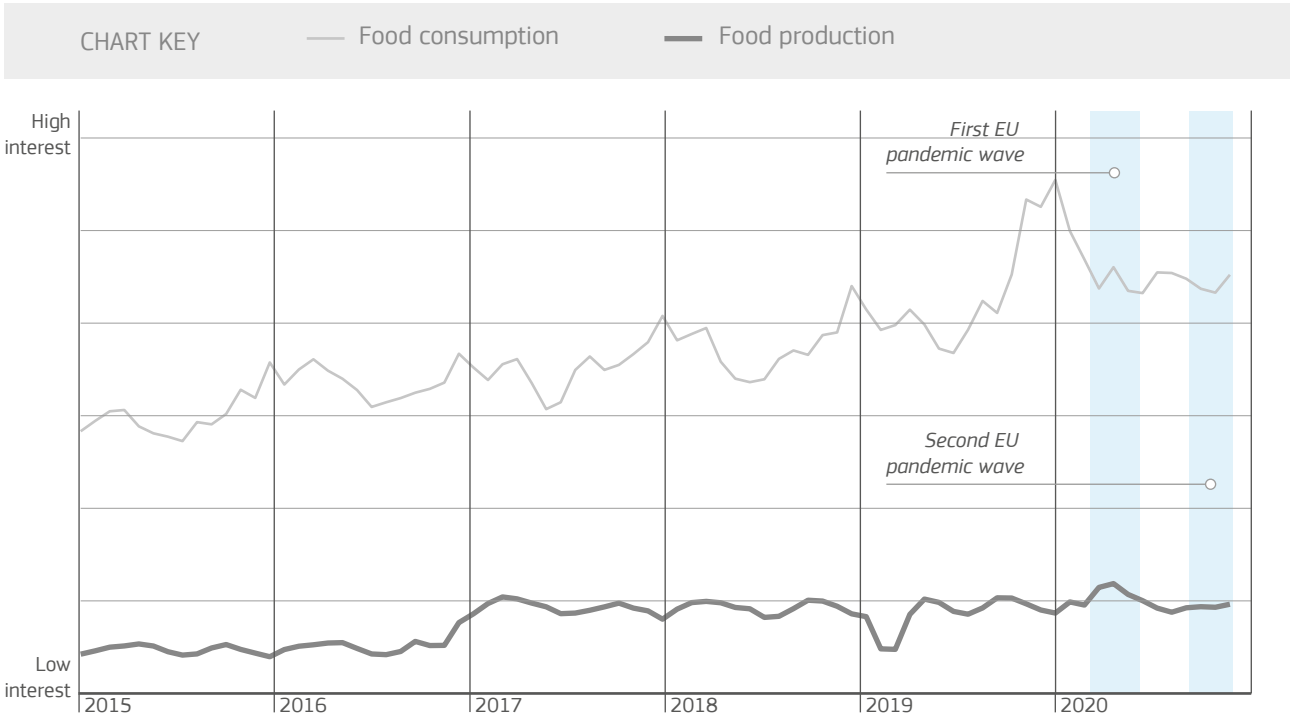


Interest in waste in the EU regions (2019 average).

Searches for waste-related topics do not show a high degree of within-country variation. At a national level though, it is interesting to notice the divide (in terms of the relative volume of searches) between countries in Eastern Europe and other Member States. This reflects the recycling rates of municipal waste across European countries, which is on average lower in Eastern Europe, with an exception for Lithuania.[5] Trentino-Alto Adige, in north-eastern Italy, is one of the regions with the highest interest in topics related to waste, and it has a particularly higher interest when compared to its neighbouring regions in Italy. Trentino-Alto Adige is also one of the Italian regions which recycles the most.[6]

5. See Eurostat, https://ec.europa.eu/eurostat/databrowser/view/t2020_rt120/default/table?lang=en
6. https://www.istat.it/it/archivio/234691

Nutrition

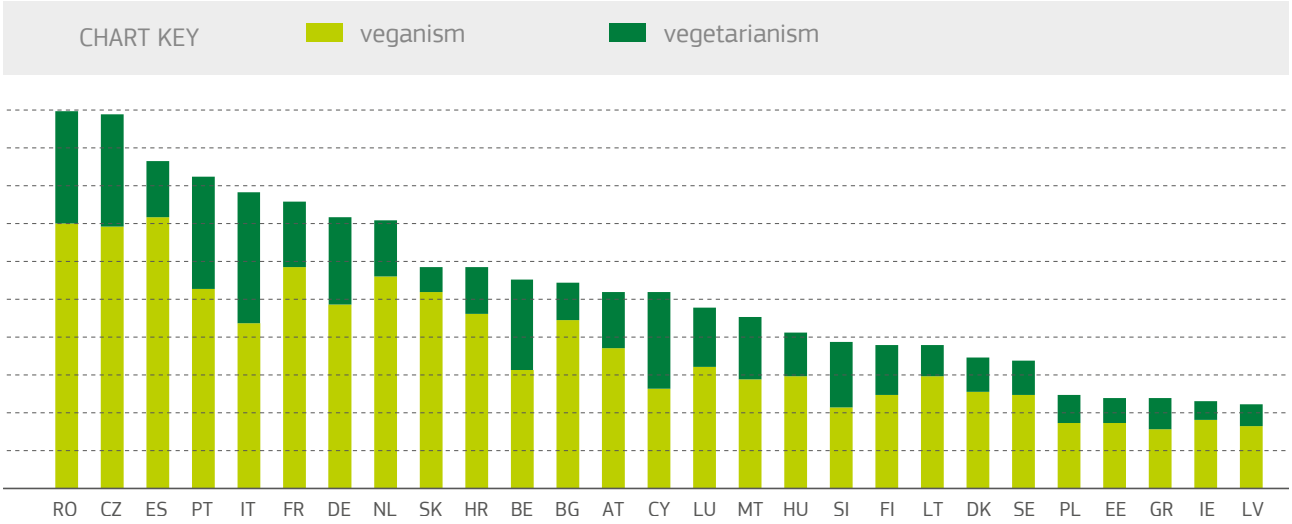


EU-27 average interest in food production and food consumption over the last six years (2015-2020).

Nutrition is at the heart of the European Green Deal, relating to two key policy areas: the Farm to Fork Strategy and a sustainable common agricultural policy. It aims to address the challenges of sustainable food systems and to recognise the tight relation between healthy people, healthy societies and a healthy planet.[7] The European Commission aims at reducing the use and risk of chemical and more hazardous pesticides by 50% by 2030. For the same year, it also aims at reducing sales of antimicrobials for farmed animals by 50% while developing the organic farming sector, with the goal of 25 % of total farmland being used for organic farming by 2030.

The continuous rise of searches for topics related to nutrition over the last five years suggests that also European citizens seem to consider thi important matter. The interest of European citizens reflects this importance showing a continuous rise over the last five years. In particular, searches related to veganism and vegetarianism are the driving topics underneath the continuous growth and 2019 peak of the food consumption sub-dimension. Regarding food production, the general trend of interest is relatively stable within each year, with a relevant peak in the time of the first lockdowns in Europe (from March to May). In a period of movement restrictions and closures of cafes and restaurants, European citizens interest in topics related to organic food and direct selling increased, possibly seeking to improve the quality of the food prepared at home. The drastic and temporary reduction of interest at the beginning of 2019 has to be attributed to changes in classification operated by Google's semantic integration algorithms. Differently, the strong increase at the end of 2017 is mainly driven by German-speaking countries, where the term bio started to be used by large retail stores for their organic products.

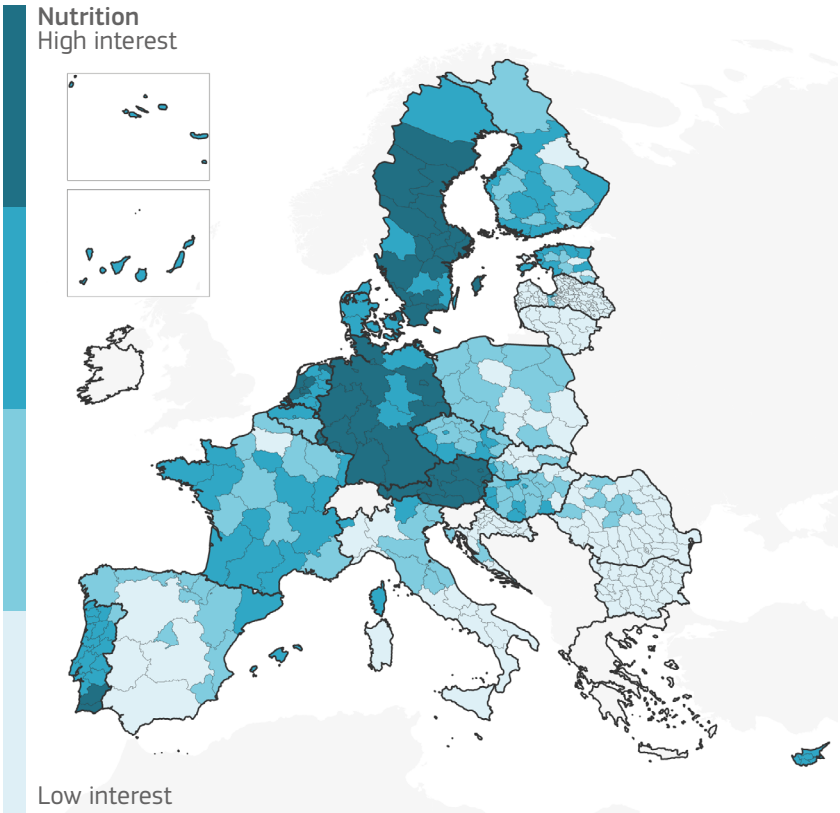
7. COM/2020/381 final



Relative volume of searches related to veganism and vegetarism in the 27 EU countries (2015-19 average).

Veganism and vegetarianism are the most represented topics of the food consumption sub-dimension, with searches for recipes often being linked with these terms. The increase in searches related to vegetarian and vegan food seem to reflect the growing popularity of these dietary choices. Indeed, European average meat consumption, which now stands at about 69 kilograms per capita, is expected to fall by a kilogram over the next ten years according to the EU agricultural outlook.[8]

In a direct comparison, vegan alternatives attract more interest than vegetarian ones across all European countries. This may reflect the fact that for the average European some vegetarian recipes are more common and already integrated within the local tradition, while vegan alternatives are less known and may require an additional search.



Interest in nutrition in the EU regions (2019 average).

The regional relative volume of searches reflects the estimated share of vegan and vegetarian citizens in EU countries. Austria and Germany, where vegan and vegetarian options are becoming increasingly popular, in particular among younger individuals, show the highest volume of searches. High levels can also be observed in other regions in Northern Europe such as the regions of Copenhagen, Stockholm and Amsterdam. A few countries show a more heterogeneous level of interest across their regions. In some cases, it is a geographical difference (like in France, Italy and Slovakia), while in other countries it may be connected with the socio-demographic characteristics of the region (e.g., Estonia, Finland and Spain).

8. https://ec.europa.eu/info/files/report-eu-agricultural-outlook-2018-30_en

Awareness

Pollution

Air
PM10
Particulates
Greenhouse
Greenhouse effect
Ozone
Ozone Layer
Air pollution
Air quality index

Soil
Hazardous waste
Soil contamination
Acid rain

Water
Microplastics
Marine pollution
Plastic pollution
Water pollution
Oil spill

Clean energy

Solar
Photovoltaic power station
Solar energy
Solar thermal energy

Hydro
Hydroelectricity
Hydropower

Wind
Offshore wind power
Wind turbine
Wind farm

Biomass
Biomass

Geothermal
Geothermal energy

Generic
Renewable energy
Renewable resource

Ecosystem

Environment
Environmental issues
Environmental protection
Nature conservation
Soil conservation
Water resources

Species
Biodiversity
Endangered species
Wildlife conservation
Threatened species

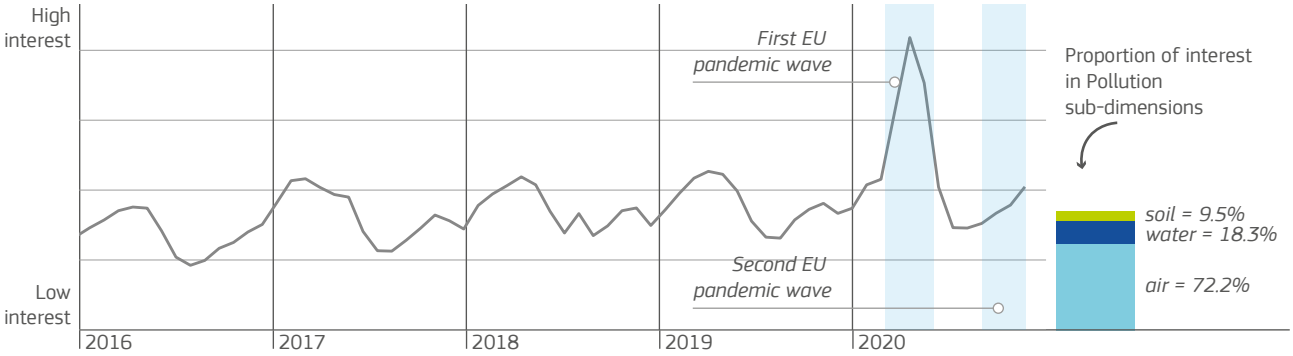
Climate

Climate change
Climate change
Climate variability and change
Climate change mitigation

Footprint
Water footprint
Carbon dioxide
Ozone depletion

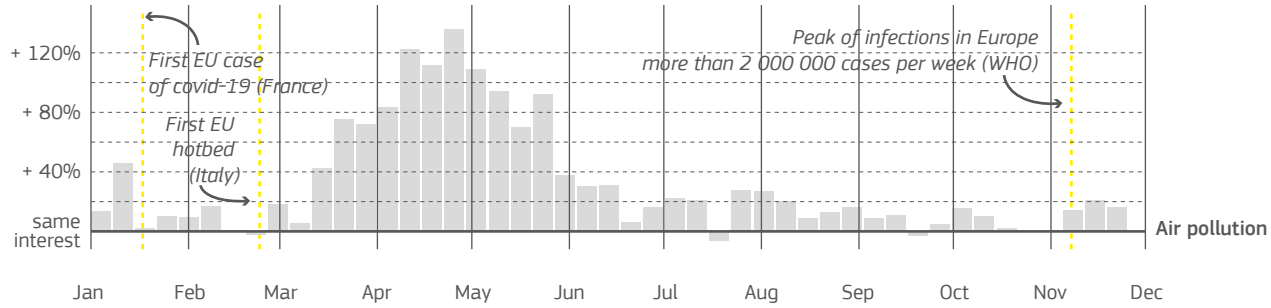
JRC Conceptual framework on citizens' awareness related to the Green Deal based on Google search data

Pollution



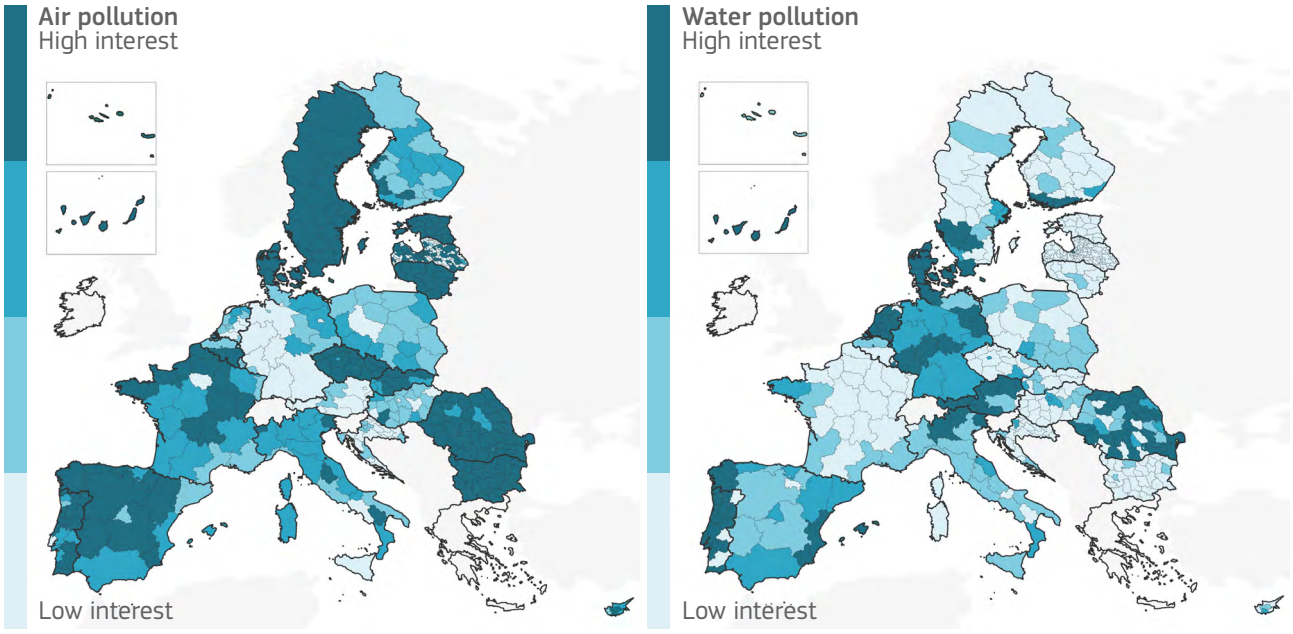
EU-27 average interest in pollution over the last five years (2016-2020).

Eliminating pollution is among the policy areas of the European Green Deal. To protect Europe's citizens and preserve Europeans' ecosystems, the Commission aims at achieving zero-pollution of air, water and soil by 2050. This goal combines several other policy areas of the European Green Deal, such as reducing pollution from excess nutrients thanks to the Farm to Fork strategy, curbing pollution from large industrial installations and preventing industrial accidents while developing more sustainable alternatives.
Yet, EU citizens' interest in topics related to air (the most searched among pollution-related topics), water, and soil pollution has been mostly stable over the last few years. A higher awareness of themes related to air, water and soil pollution might help the Commission reach its ambitious goals. In this sense, the SARS-CoV-2 might have brought some important and unexpected positive developments. Indeed, during the first peak of the pandemic, interest around pollution soared, increasing by more than 100% from the pre-pandemic levels.



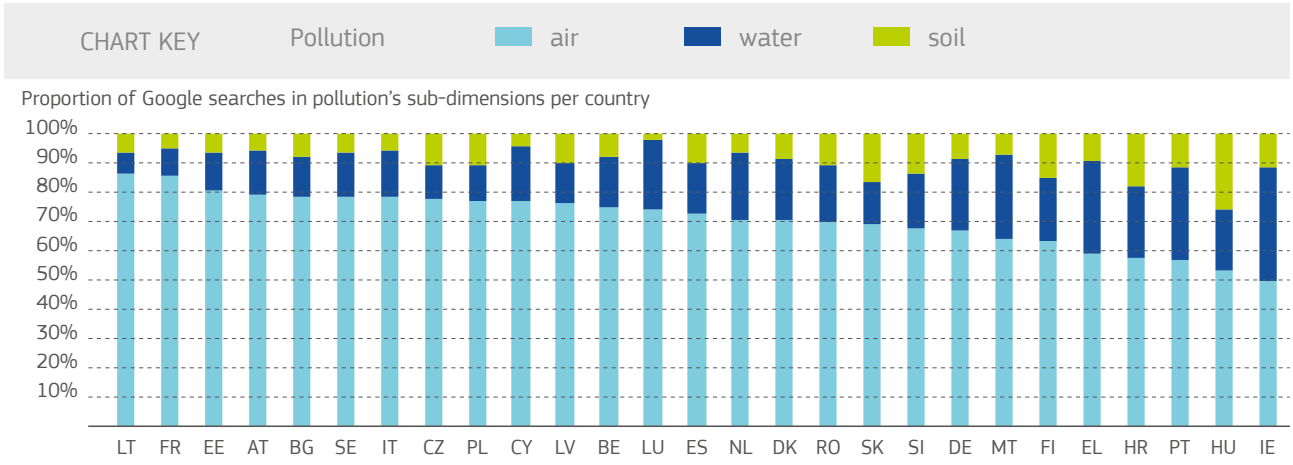
Difference of interest in topics related to air pollution between 2020 and 2019.

The main driver of this dynamic was the increase in the relative volume of searches for topics related to air pollution. As the SARS-CoV-2 pandemic unfolded, interest in air pollution increased for, mainly, two reasons. On one hand, the early scientific evidence suggested that people living in areas with high levels of air pollution could have been more likely to show symptoms and to suffer more from the disease. On the other hand, news began reporting on how lockdown measures resulted in reduced air pollution due to the lower number of cars circulating on European streets. Importantly, even after the first wave of the SARS-CoV-2 pandemic ended, the interest for topics related to air pollution remained about 20% higher than the 2019 average, suggesting that the impact of the covid-19 pandemic on the citizens' awareness of air pollution might not be short-lived.



Interest in air and water pollution in the EU regions (2020 average).

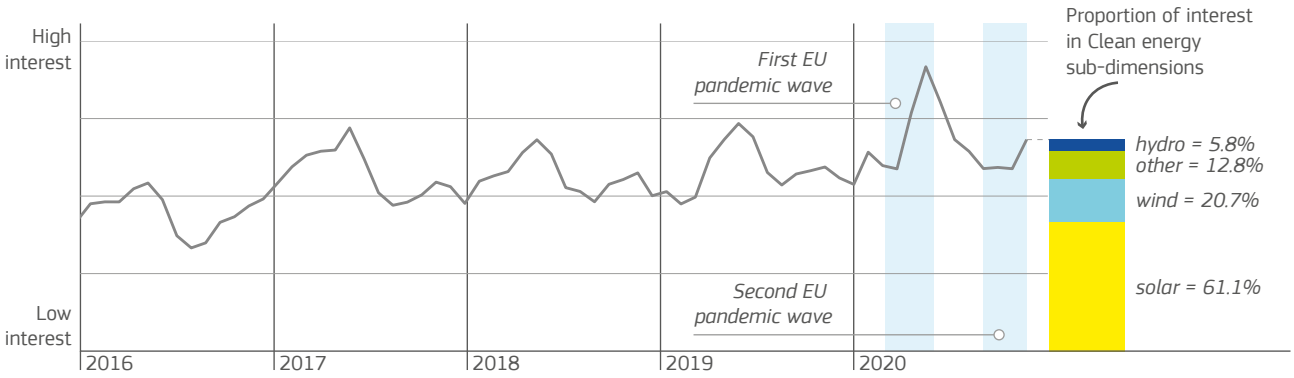
It is also interesting to notice how the pandemic did not have the same impact on pollution-related searches in all EU countries and regions. For example, in 2020, the relative interest for air pollution in German regions has been low as compared to other regions in Europe, while the interest for water pollution has been higher. The opposite happens in the regions of France, Sweden and the Baltic states, where the relative level of searches for air pollution is high while water pollution is less searched for. Denmark and Portugal have regions ranking among the first in both air and water pollution web searches. Finally, it is interesting to observe how in the regions of Belgium and the Netherlands, despite the high population density, air pollution is not highly searched for, while the opposite is true for water pollution.



Interest in pollution (air, water and soil) in the 27 EU countries (2016-2020 average).

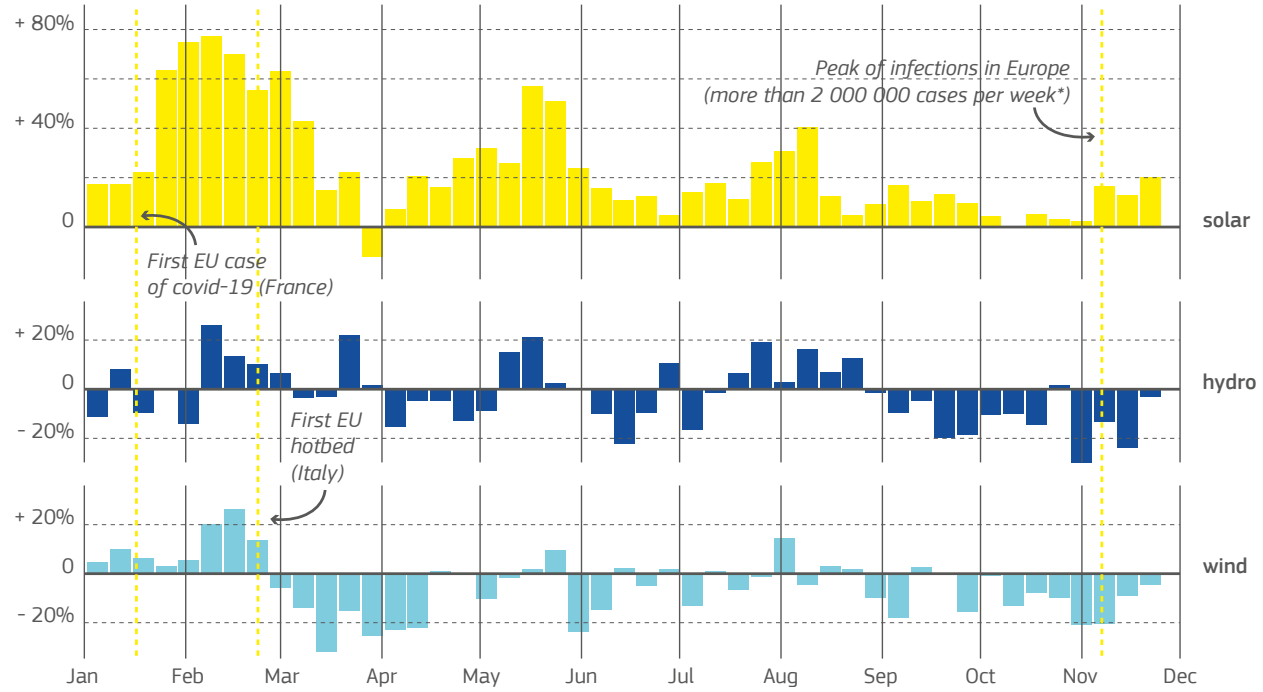
Finally, Lithuania, France and Austria show the highest proportion of searches for air pollution, which captures about 80% of total searches for pollution. The opposite is true for Hungary, where searches for soil pollution capture almost 30% of total searches for pollution. Also in other countries where the sea represents an important resource, such as Ireland, Portugal, Greece and Malta, searches for water pollution are more frequent.

Clean energy



EU-27 average interest in clean energy over the last five years (2015-2020).

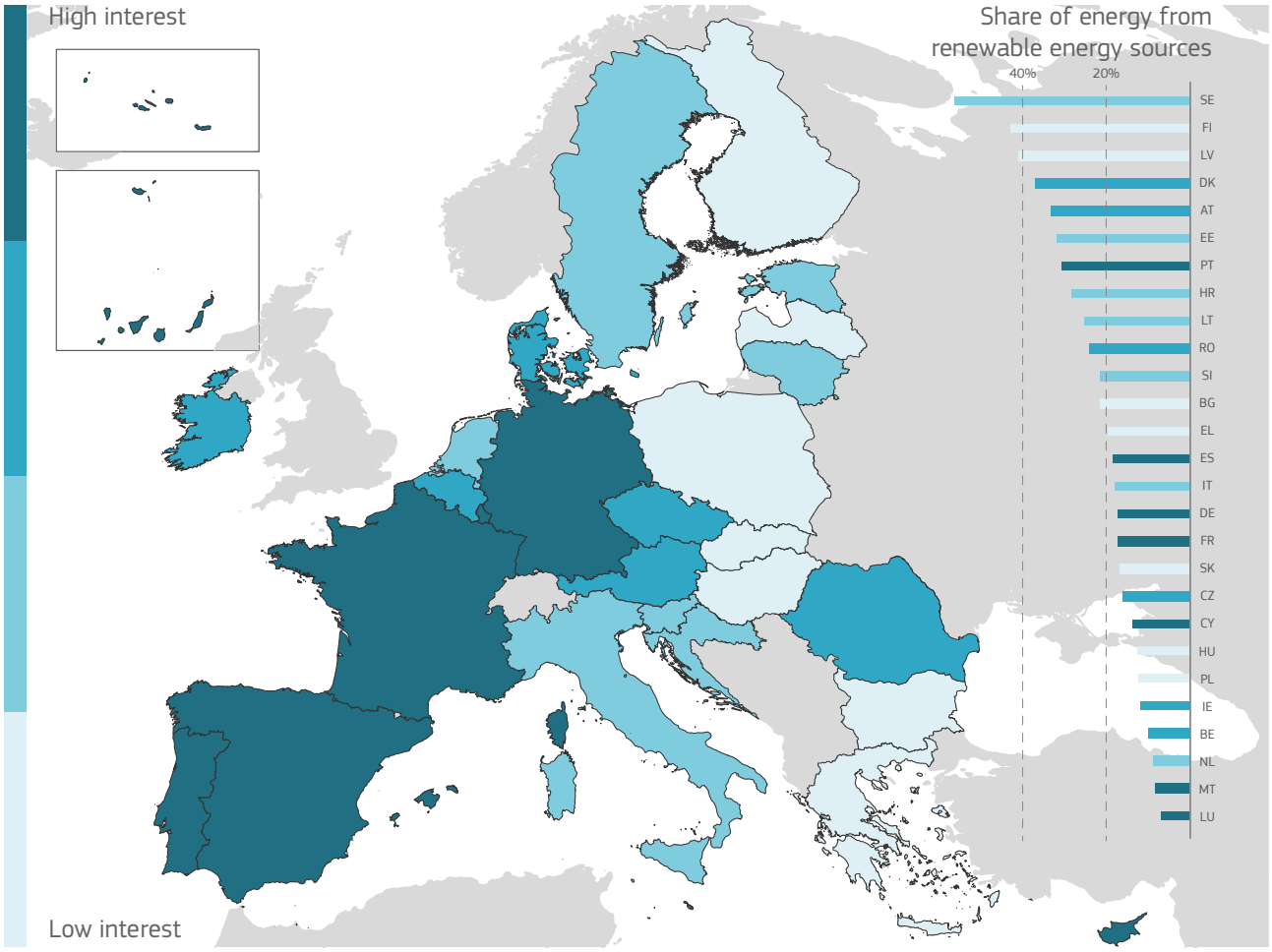
In 2020, confinement measures due to the pandemic caused a huge drop in energy demand. Further, lockdowns temporarily delayed the construction of new renewable energy sources (RES) installations.[9] Despite that, Google searches on RES reached the highest interest ever in May this year. Among the sub-dimensions related to clean energy, solar energy (gathering the following topics: photovoltaic power station, solar energy, solar thermal energy) seems to be the most-searched subject.



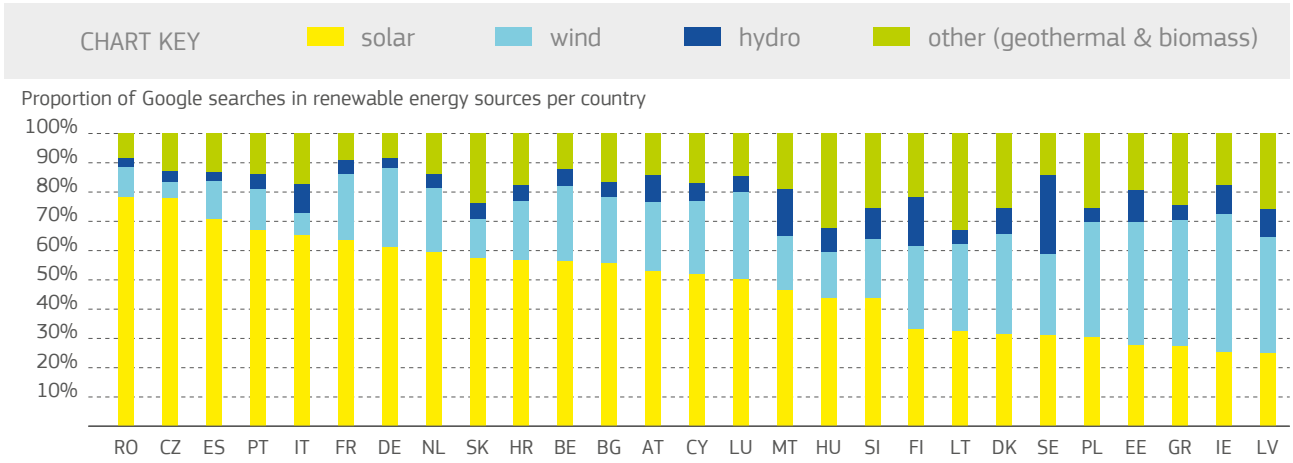
Difference in interest between 2019 and 2020 in solar, hydro and wind.

The increase in interest in solar energy is further confirmed during 2020, being almost continuously higher than in 2019. From the end of January to the beginning of April, Google searches for topics related to solar energy were over 60% higher than in 2019, and in February almost 80% higher than in 2019.
The other RES didn't follow the same trend, maintaining a fluctuating interest, often lower than 2019, during all 2020.

9. IEA (2020), Renewables 2020. Analysis and forecast to 2025: https://www.iea.org/reports/renewables-200



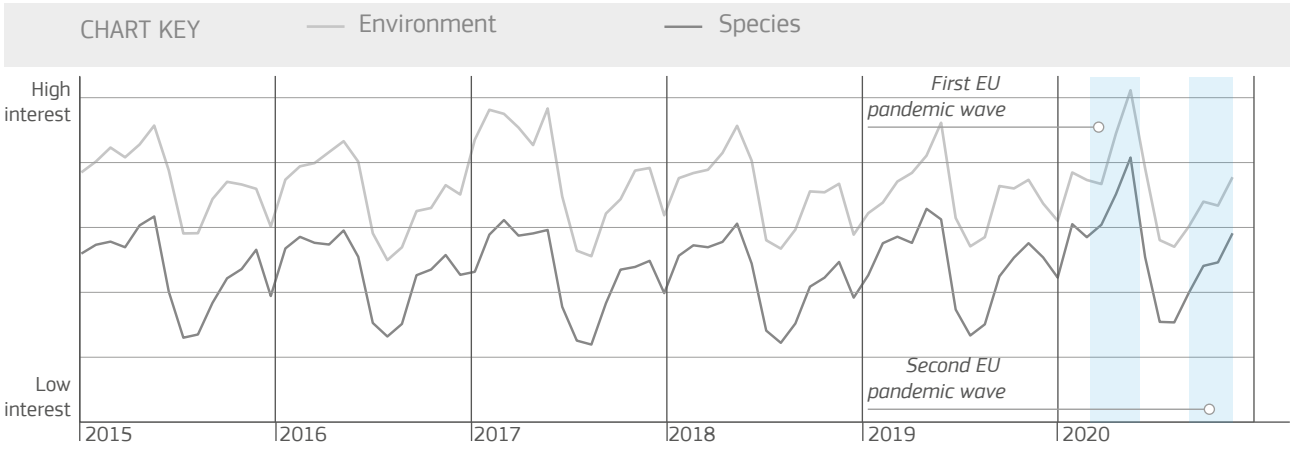
Map: Interests in clean energy in the 27 EU countries (2015-2019 average). Bar chart: Overall share of energy from renewable sources in 2019 (Eurostat). Bars colours are referring to the interest in the topic (same as the map).



Interest in renewable energy sources (solar, wind, hydro, other) in the 27 EU countries.

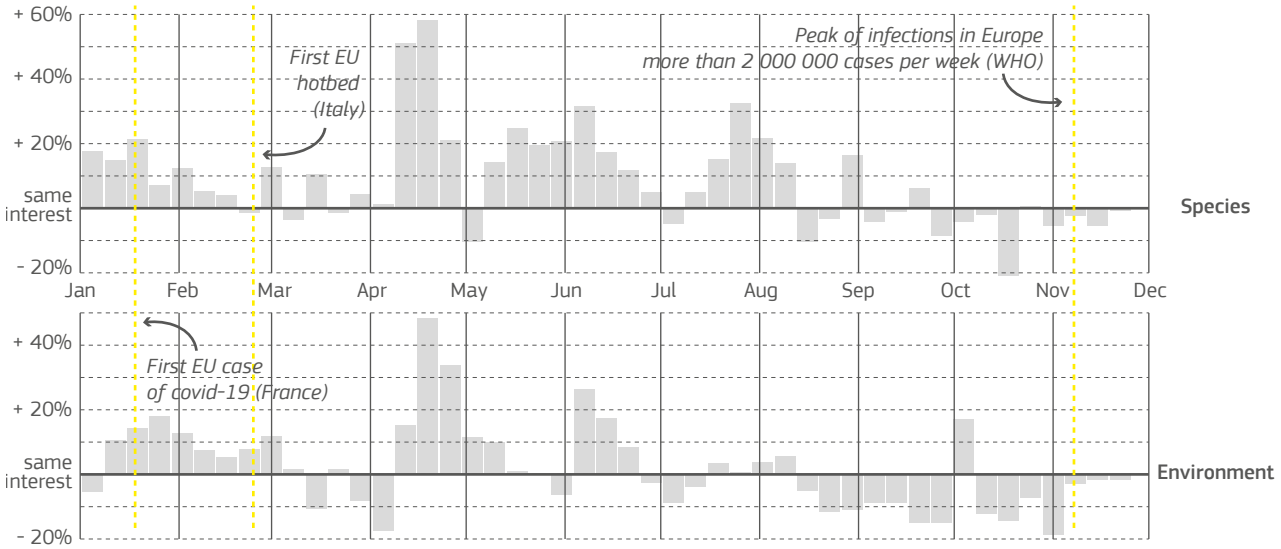
Considering the pre-pandemic period (2015-2019), interest in clean energy was particularly high in Cyprus, France, Germany, Luxembourg, Spain and Portugal, followed by the other Central-European countries, Ireland and Romania. In most EU countries more than 50% of Google searches for RES are related to solar energy. In the other countries, interest in wind energy is the highest among the four sources analysed, exception for Hungary, Lithuania and Slovenia, where the most searched energy sources are biomass and geothermal.

Ecosystem



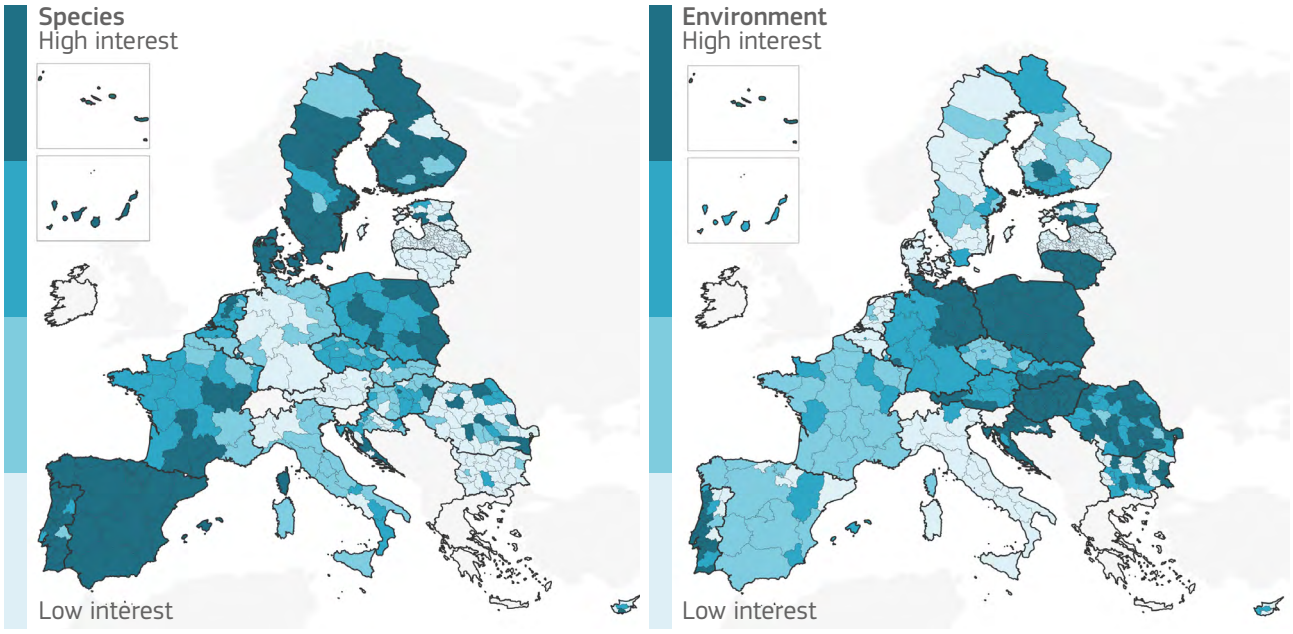
EU-27 average interest in environment and species over the last six years (2015-2020).

Among the policy areas of the European Green Deal, protecting ecosystems and biodiversity plays a crucial role. A significant proportion of the 25-percent-budget to climate action will be invested in biodiversity and preserving European ecosystems. The EU Biodiversity Strategy for 2030 started in May 2020. On the day of its launch, President Von Der Leyen commented "[m]aking nature healthy again is key to our physical and mental well being and is an ally in the fight against climate change and disease outbreaks".
Europeans' interest in topics related to ecosystems follows stable trends with seasonal variation. The same structure was respected in 2020, albeit an increase of the interest can be observed during the first European lockdowns for both searches related to species and the environment.



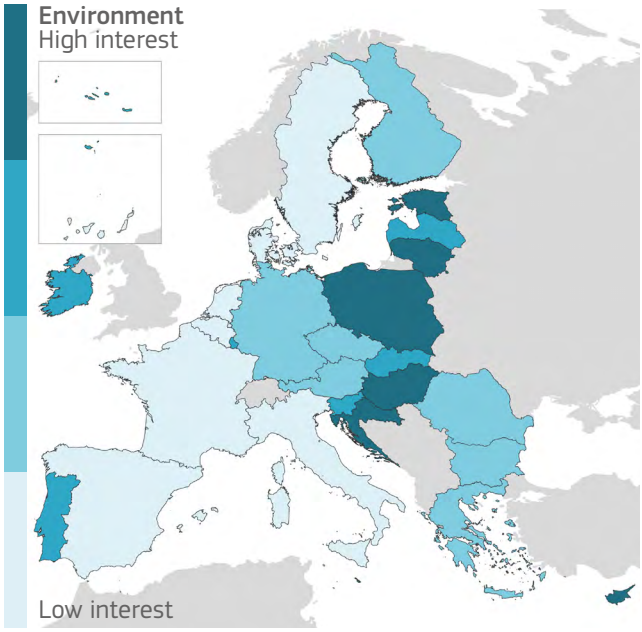
Difference in interest in species and environment between 2020 and 2019.

A direct focus on the percentage differences of interest between 2020 and 2019 draws a similar pattern for the two sub-dimensions of ecosystem, in particular for the first part of the year. Indeed, interest for both species and environment is, on average, higher in 2020 with peaks in April. After summer, searches for species-related topics remain similar to those of 2019, while searches related to the environment gather less interest with respect to the same months of 2019.

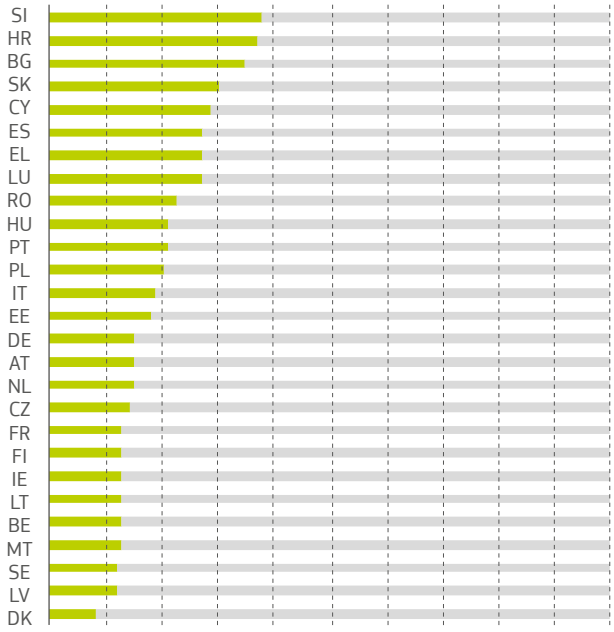


Interest in species and environment in the EU regions (2019-20 average).

The geographical distribution of interest for species or the environment is very diverse. Searches related to species contain topics such as biodiversity and wildlife conservation, and capture more interest in Spain and Portugal and the Nordic countries Denmark, Finland and Sweden. Conversely, all regions of Latvia and Lithuania share the same low level of interest. Searches for environment contain instead topics such as environmental protection and nature conservation, capturing higher interest in Eastern Europe (as in Croatia, Hungary, Lithuania, Poland and Slovakia) and the north-east of Germany.



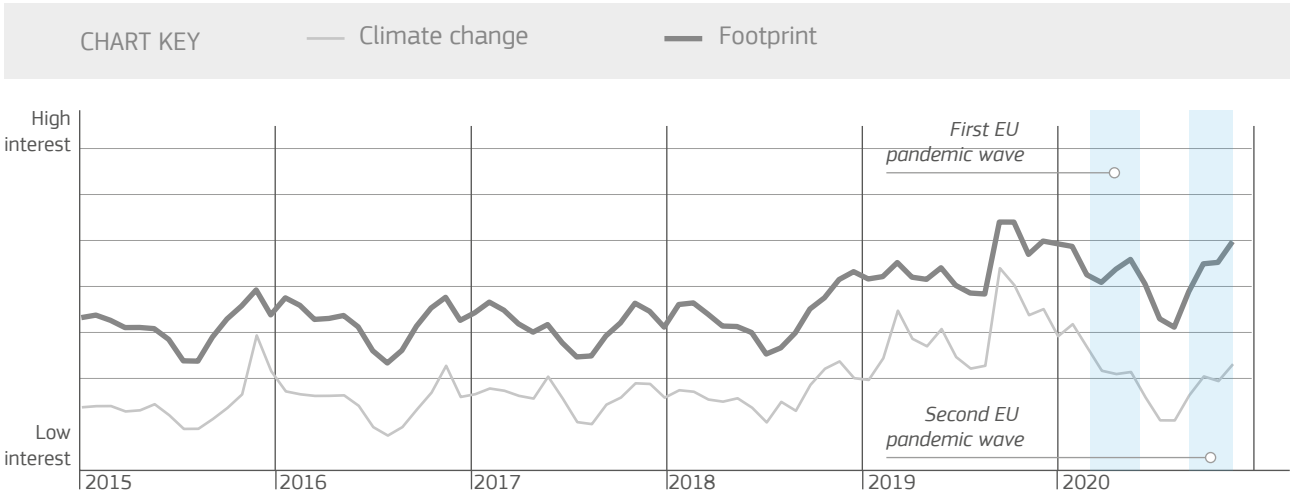
Interest in environment in the 27 EU countries (2020 average).



Terrestrial Natura 2000 area in 2019 (% of total national area)

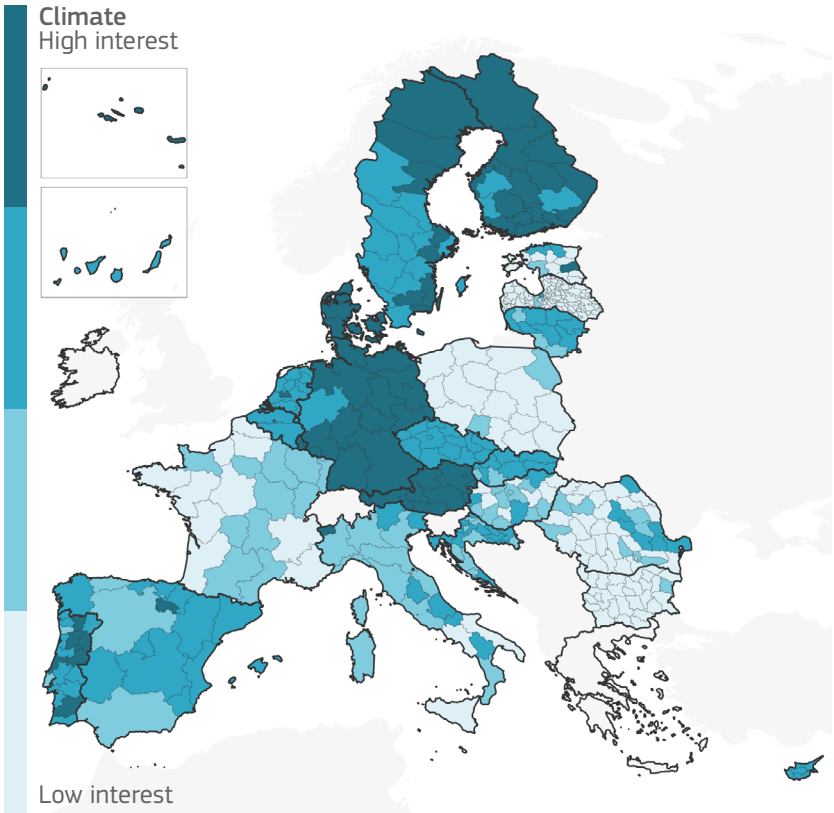
Finally, it is interesting to notice how the national differences in searches related to the environment are linked with the share of total land area designated under Natura 2000, a network with the goal to maintain or restore a favourable conservation status for habitat types and species of EU interest. Indeed, several Eastern European countries where searches for topics such as environmental protection and nature conservation are at their highest, are also the countries in which a larger share of the land area is designated under the Natura 2000 network of protected areas.

Climate



EU-27 average interest in climate change and footprint over the last six years (2015-2020).

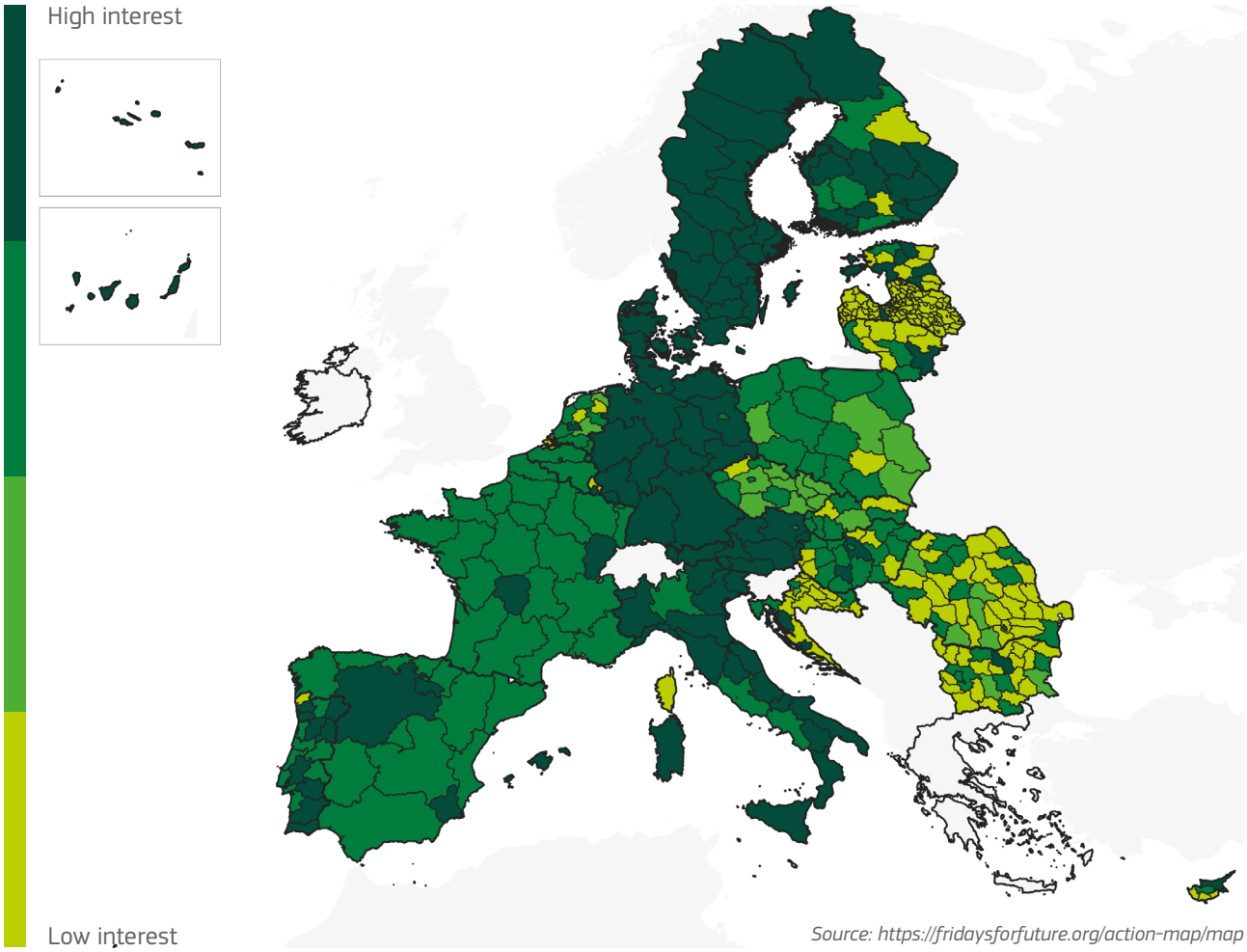
In recent years the attention towards climate change and the impact our activities have on the planet has been rising. The Paris Agreement, adopted at the end of 2015, sets a goal to limit the increase of temperature to below 2.0 degrees Celsius compared to the pre-industrial level. This comes as impacts of climate change on the economy and society - on top of ecosystems and biodiversity themselves - is becoming increasingly evident. The World Bank estimated that more than 100 Million people could fall into extreme poverty by 2030 if no action is taken.[10]



Interest in climate in the EU regions (2019 average).

Looking at topics related to climate change, it is possible to notice a peak towards the end of 2016. This peak comes shortly after the entry into force of the Paris agreement on November 4th. Related search keywords across European countries in the same period suggest a relation between this peak and both the Paris agreement and the newly elected President of the United States. The second peak comes during the Global Week of

10. Hallegatte, Stephane; Bangalore, Mook; Bonzanigo, Laura; Fay, Marianne; Kane, Tamaro; Narloch, Ulf; Rozenberg, Julie; Treguer, David; Vogt-Schilb, Adrien. 2016. Shock Waves : Managing the Impacts of Climate Change on Poverty. Climate Change and Development;. Washington, DC: World Bank. © World Bank. https://openknowledge.worldbank.org/handle/10986/22787 License: CC BY 3.0 IGO.



Source: https://fridaysforfuture.org/action-map/map

Friday for Future Events per 100 000 inhabitants up to 2020.

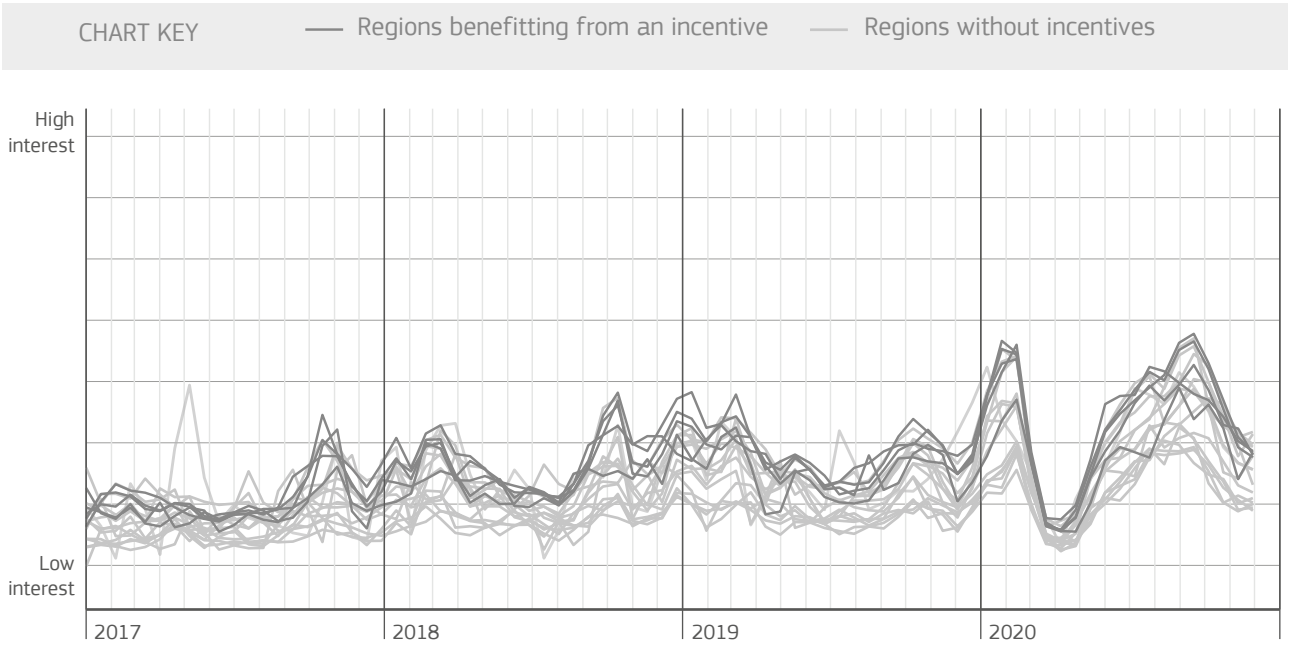
Climate Action and shortly after Greta Thunberg's speech at the United Nations Climate Action Summit on September 23rd 2019. Footprint seems to have a more regular trend, exception made for a relevant increase at the end of 2018. The relative interest for climate change and footprint both decreased at the onset of the covid-19 pandemic with a drop during the summer months, which has been more significant than in the previous two years. A higher volume of searches for topics related to climate can be identified in Denmark, Ireland and Germany. The interest in climate change seems to be concentrated in Northern-European countries over the past five years.

At the regional level, it is possible to notice that during 2020 the interest for topics related to climate has concentrated in regions in Lithuania, Denmark, Germany and Austria, where the interest level has been among the highest in Europe, followed by regions in Finland and Sweden. The interest seems to concentrate in Central- and Northern-European regions, with the exception of Portuguese regions where the interest is rather high, some Croatian, Estonian and Cypriot regions, followed by isolated regions in Spain and Italy. Finally, it is interesting to observe how some of the regions showing a higher interest for topics related to climate, are also regions in which the number of events organised (population-weighted) in the context of the Friday For Future movement is higher.

The effects of policies on people's interests

Causal insights using Green Deal-related web searches

The indicators presented in this report can help to understand how EU citizens' web behaviour on subjects linked to the European Green Deal evolved over time and across countries and regions. In addition, the indicators could be exploited to provide insights on how EU citizens' interests change following the implementation of green policies or in the aftermath of events affecting their daily lives. Using a difference-in-differences methodology, this section provides two examples on how the indices could be applied both at regional and national level to obtain causal insights.



Interest in hybrid vehicle in Italian regions. Note: darker lines represents the region benefiting from an incentive, lighter those who do not. Valle d'Aosta not included due to sampling issues.

Promoting low-emission vehicles: the case of Italian regions

Transport accounts for about a quarter of the Union's greenhouse gas emissions and these continue to grow. The European Green Deal seeks a 90% reduction in these emissions by 2050. In particular, according to the European Commission[11], cars are responsible for about 12% of total EU emissions of carbon dioxide (CO_2), the main greenhouse gas. Therefore, starting in 2009, the European Commission, with the Regulation 443/2009, began setting mandatory emission reduction targets for new cars. From 2021 (phased in from 2020) the EU fleet-wide average emission target for newly produced cars will be 95 grams of CO_2 per kilometre.

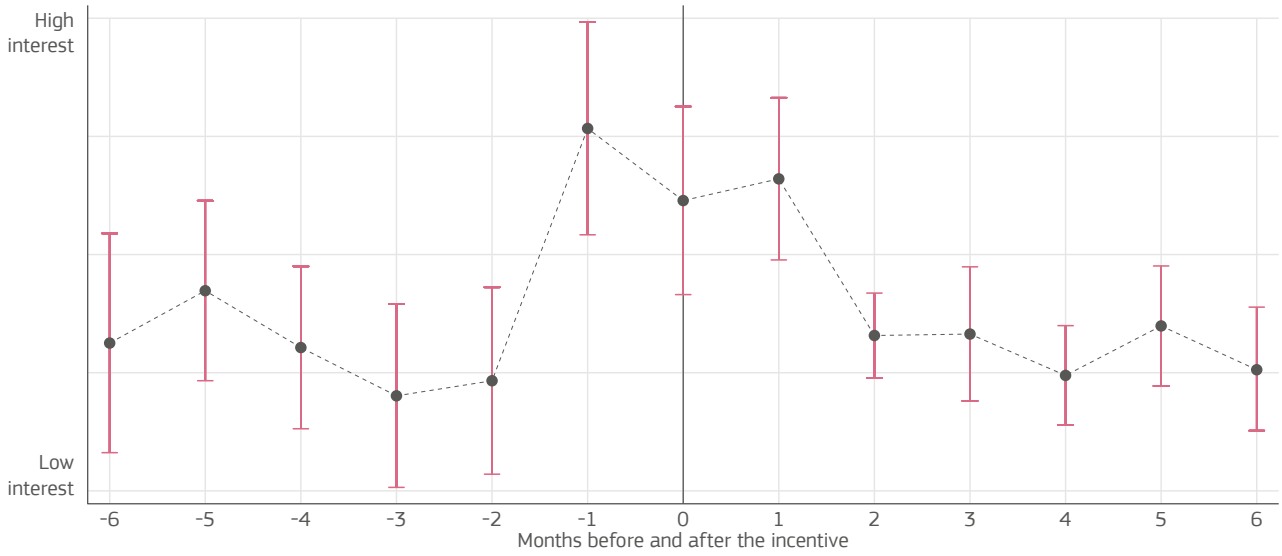
Recently, EU Member States began to issue economic incentives, in the form of tax rebates and/or subsidies to private citizens and/or companies to purchase low-emission cars. Starting in 2017, six Italian regional authorities (Friuli Venezia-Giulia, Lombardia, Piemonte, Trentino Alto-Adige, Valle d'Aosta and Veneto) began introducing, at different points in time, economic incentives directed to private citizens to encourage those

11. https://ec.europa.eu/clima/policies/transport/vehicles/cars_en

residing in the regions to replace old and high CO_2 emission cars with low CO_2 emission cars. In most cases, the lower the car nitrogen oxides (NO_x) and CO_2 emission was, the highest the economic incentives. As an example, the Lombardia regional authority implemented an economic incentive scheme ranging from 2 000 to 8 000€ depending on the combined NO_x-CO_2 emission per kilometre. Those cars emitting 0 milligram of NO_x and CO_2 per kilometre (electric vehicles) could qualify for a 8 000€ subsidy; cars with CO_2 emissions per kilometre ranging from 95 to 130 could qualify for a subsidy from 2 000 to 4 000€ depending on the NO_x emission levels.

Economic incentives are reflected in the trend in interest for the topic 'hybrid vehicle' (which captures the majority of queries performed on the Google Search engine related to low-emission cars). Those regions where economic incentives have been introduced, seem to have, on average, a higher level of interest in low-emission cars as they display a higher relative number of web searches related to such cars. However, from the graphs, it is difficult to say whether the policies in those regions successfully raised citizens' interest in (and thus, to some degree, purchases of) low-emission cars or whether this is due to other factors.

To test the causal effect of implementing the policies on the interests of the citizens residing in those regions, the JRC adopts a difference-in-differences methodology. Intuitively, this approach compares regions exposed to the policy with non-exposed regions (difference), before and after the introduction of the policy (in differences). Under the assumption that differences between exposed and non-exposed regions are constant over time in the interval under analysis, then the trends in web searches for queries related to hybrid vehicle(s) in non-exposed regions provide a good counterfactual scenario in the absence of the policy.



The effect of economic incentives on searches for hybrid vehicles in Italy. Vertical bars represent 95% confidence intervals.

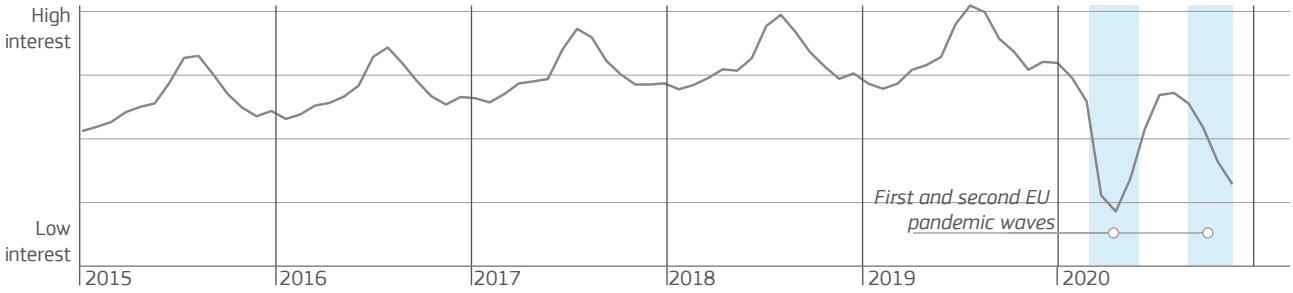
The analysis shows how, shortly before the economic incentive is officially implemented by the regional authority, searches for queries related to the topic hybrid vehicle increase by about 50% from their earlier trends. The search volume is sustained in the month in which the economic incentive is officially implemented and in the one after, before returning close to pre-policy levels in the following months.

Overall, this seems to suggest that economic incentives for low-emission cars have successfully raised the relative number of web searches for such vehicles. This also translated, to some extent, into purchases of such cars, as the funds established to support such incentives quickly ran out. Given the importance of low-emission cars and more sustainable mobility in reaching the goals set by the European Green Deal, economic incentives to purchase cars with low- or zero-impact on the environment, if well targeted, might play an important role.

Public transport in the wake of the first lockdowns

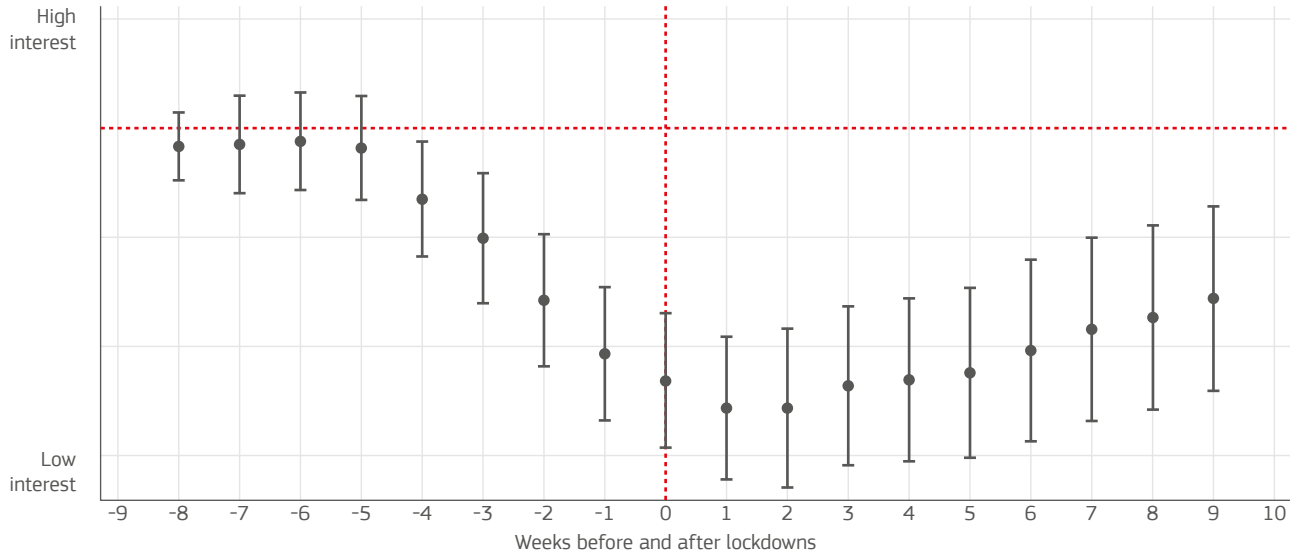
Public transport, particularly in urban and densely populated areas, is complementary to the replacement of high-emission cars with low-emission ones in achieving the European Green Deal goal of a 90% reduction in greenhouse gas emissions in transport by 2050. Low-emission public transport, such as electric buses and trains, could serve the double goal of reducing urban congestion and CO_2/NO_x pollution, thereby making EU cities healthier and easier to live in.

To achieve this goal, the European Commission, through the European Structural and Investment funds as well as the CIVITAS (CIty, VITAlity and Sustainability) initiative, provide funding and guidance to help the transition towards greener and more efficient public transport. The increase in the relative interests of European citizens in themes related to public transport over the years, has unfortunately been brought to a halt by lockdowns and measures of social distancing imposed by the covid-19 pandemic. Searches related to public transport usually contain searches for tickets, timetables, itineraries and weekly/monthly/yearly passes.



Interest in public transport over the last six years.

To understand what has been the impact of lockdown measures on searches for public transport, the JRC estimates the effect of lockdowns on web searches using a differences-in-differences methodology. Importantly, results suggest that searches for queries related to public transport decreased a few weeks before lockdowns and movement restriction measures were officially implemented by (some) EU countries during the first wave of the covid-19 pandemic.



The effect of lockdowns and restrictive measures on searches related to public transport

This suggests that the effect in the decrease in interests for public transport (and, therefore, to some degree in their use of such transport) is not solely driven by official measures to fight the pandemic, but also by self-imposed measures that EU citizens took to protect their health and reduce the risk of contagion. This, in turn, provides insights suggesting that private transport (as shown before) will likely be preferred, when possible, to public transport, until the latter will not be felt as safe by European citizens.

Methodology

The analysis is performed using search data available through the Google Health Application Programming Interface (API), which provides access to information on a representative sample of searches performed on the Google Search engine. The Google Health API returns information normalised to the time and location of a query. By time range (weekly in this report) and geography (country or regional level) each data point is divided by the total searches to obtain relative popularity. This provides advantages over the usage of Google Trends data which, after being rescaled are also normalised on a 0 to 100 scale. However, results shown in this report do not represent the absolute volume of searches, but rather their volume relative to the total amount of searches. Changes over time for a particular search term could therefore be driven by changes in the absolute search volume, changes in the volume of other searches or a combination of the two.

The Google Health API also returns top related searches and topics. Top searches are terms that are most frequently searched with the term users enter in the same search session within the chosen category and geography. Topics, which have started being available in late 2013 in the US and the following years in EU countries, are instead aggregations of different related queries that could be assigned to a particular concept. Aggregation is done by Google using semantic integration algorithms in the context of the Google knowledge graph.[12]

In this report, the JRC uses topics rather than search terms as the former provides a few advantages. First, it is possible to easily use topics to perform a cross-country analysis, whereas the same does not apply with keywords even if they are correctly translated. Evidence shows that search terms related to the same topic vary across countries due to cultural differences. Further, searches linked to topics might vary across time. Finally, all queries broadly related to a topic are linked to the given topics independently from the spelling and wording of the query.

To select the topics included to create the indicators contained in this report, the JRC adopts both a data-driven and data-informed approach. First, JRC researchers selected a few topics related to the policy areas of the European Green Deal, i.e., *Air pollution*, *Renewable energy*, *Electric vehicle*, *Recycling*, *Organic food*. These topics are then used as a seed to retrieve all topics linked to them. Then the retrieved topics are used as a seed themselves to retrieve all related topics. This procedure resulted in a list of more than 2 000 topics. Using a data-informed approach, the JRC then selected only those topics relevant in the context of the European Green Deal while organising them according to the theoretical framework that is presented in this report.

While this approach has clear advantages, some caveats apply. First, while searches are informative for the population in the working age and about 90% of EU households have internet access, younger individuals are more likely to use the internet than the elderly.[13] Further, access to the internet is not random with respect to socio-economic status.

Maps scales are based on quartiles of the distribution of the variable of interest. EU-27 averages are population-weighted.

12. https://blog.google/products/search/introducing-knowledge-graph-things-not/
13. See Eurostat, Digital Economy and Society Data, https://ec.europa.eu/eurostat/web/digital-economy-and-society/data/database

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