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The pandemic & Ireland's Energy System

What are the impacts on Irish greenhouse gas emissions?

James Glynn, Siddharth Joshi, Maarten Brinkerink, Hannah Daly, Paul Deane, Shane McDonagh, Connor McGookin, Laura Mehigan, Clare Noone, Marguerite Nyhan, Vera O'Riordan, Fionn Rogan, Alparslan Zehir & Brian O Gallachoir

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COVID19 Lockdown measures across the globe are creating a natural experiment for climate and energy researchers to observe how extreme demand scenarios can drive large scale fossil fuel demand destruction and collapse oil market prices.

What does this mean for Irish greenhouse gas emissions?

Does it tell us anything about the feasible pace of societal change to mitigate climate change?

What we expect to see from real time energy numbers and air quality data sets is a reduction in energy demand over the course of COVID-19 lockdown, but does this also means emissions go down?.

MaREI researchers present an overview of near real-time data sources to give an up to date picture of what is going on in the energy system, and the estimated changes to levels of pollution.

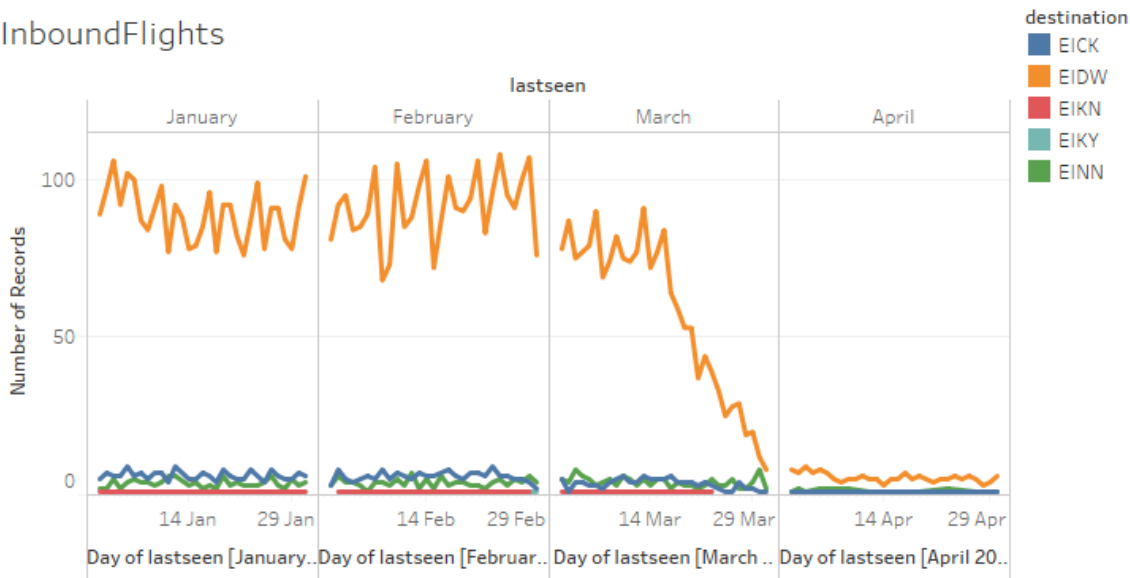
TRANSPORT - The transport sector has shown sizeable reduction in activity

Transport plays an important role in everyone's daily life. We commute to work, collect groceries, or travel for leisure activities. The energy we use for transport accounts for about 40% of Ireland's energy consumption. The COVID-19 restrictions have had an unprecedented impact on transport demand across all modes, planes, trains and automobiles, both public and private.

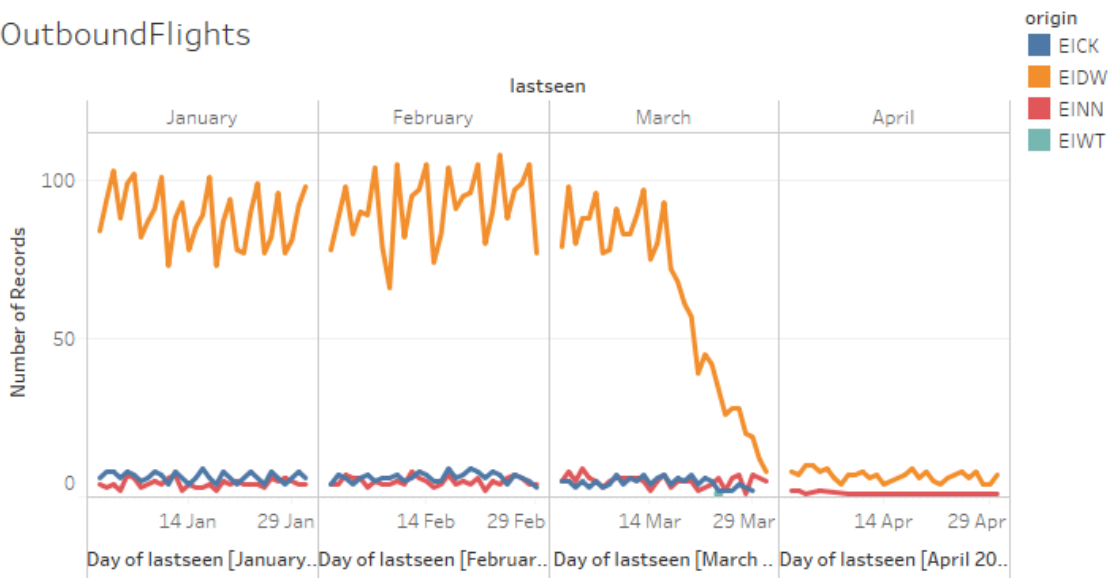
Planes

In Ireland, flights are responsible for 3.3 million tonnes (Mt) of CO₂ emission every year. Nearly 9 out of 10 flights have been cancelled since the restrictions began, while the remainder are flying with few occupants or to carry goods. Assuming flight restrictions last for 12 weeks, and that there will be another 12 weeks with partial recovery, this could result in a reduction of 1 MtCO₂ of heat trapping gases this year. Given the difficulties the airlines are likely to face with continued social distancing impacting upon tourism, the final reduction in CO₂ emissions from aviation may be considerably higher.

InboundFlights



OutboundFlights



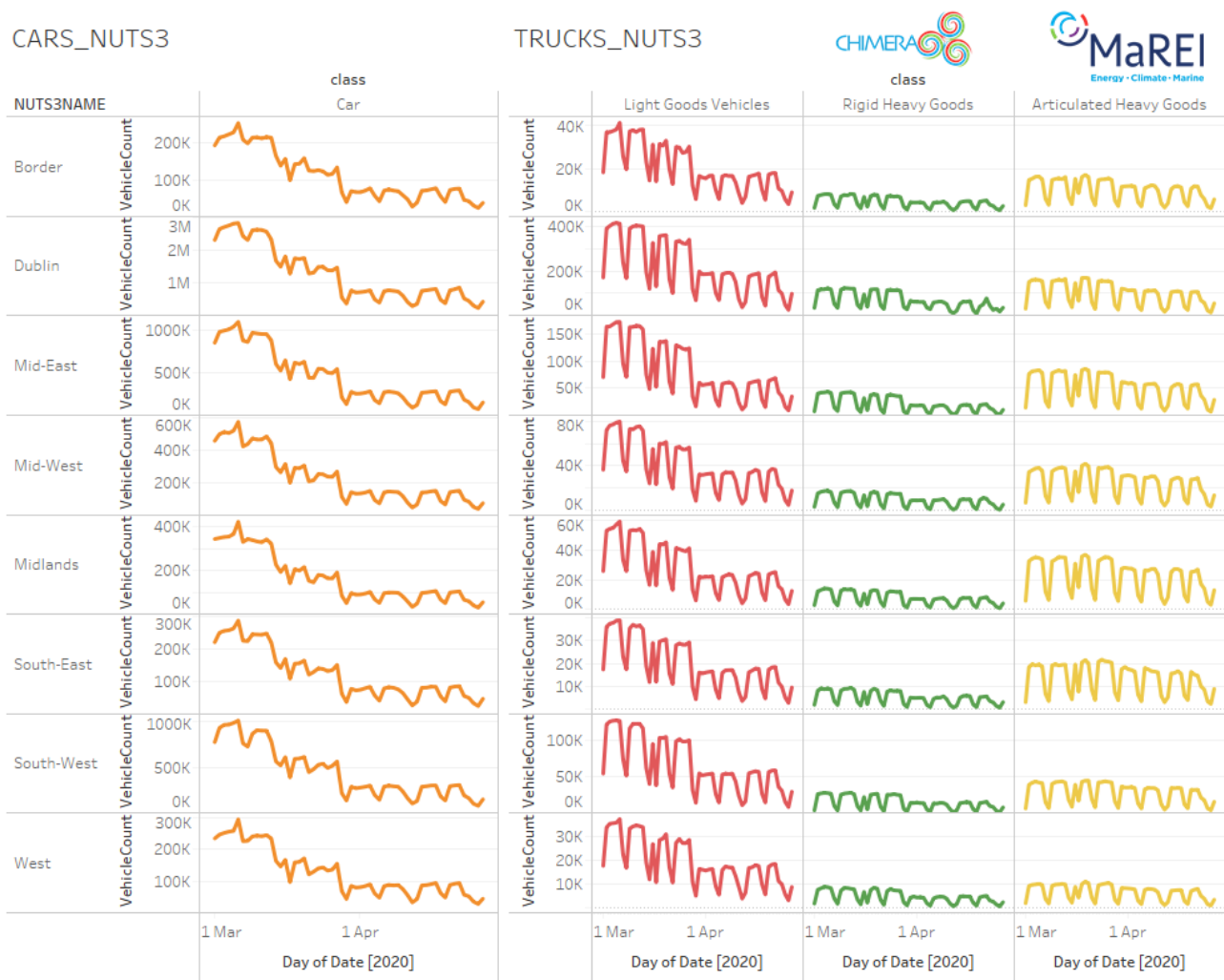
Trains

Restrictions began on the 30th March for Irish Rail services across the republic including the (DART). According to the transport operator, CIÉ, both DART and intercity services are now operating at 45% - 65% of their normal levels. Oil provides 90% of rail sector fuel consumption, the remainder by electricity. CIÉ reported that annual rail emissions of 177,000 tonnes of CO₂ in 2018. In a 12 week restricted schedule scenario, operating at 55% service, a carbon reduction of 22,000 tonnes of CO₂ may be realised.

Automobiles

Private vehicle transport traffic volumes have plummeted by >85% since early March. In a typical year, private vehicles are responsible for about 6MtCO₂. That's nearly twice as much as flights. Based on 12 weeks of restrictions and another 12 weeks with partial measures, there could be a reduction of 1.5 MtCO₂ due to the travel restrictions. Google's mobility report has also highlighted a 76% reduction in leisure travel and a 54% reduction in commuting for work. In line with the drop in all economic activity, car sales in March were 33% lower than March 2019; however, sales of EVs bucked this trend, increasing by 41%. Sales of new EVs briefly bucked the downward trend in March when they increased by 41%. However in April EV sales re-aligned with national trends when sales decreased by 67%.

Travelling to work and school accounts for over a third of the journeys taken by Irish people each year. This means the lockdown will lead to a significant reduction in fuel consumption as well as associated CO₂ emissions. For example, each week the school run requires Irish parents to drive a staggering 7 million kilometres, emitting an estimated of 1.2 ktCO₂, equal to the annual mileage of about 400 cars. Besides avoiding emissions, anyone without young kids to manage is also saving time. In Ireland, the average commuter spends 28.2 minutes driving to work (and many a great deal longer), so roughly 1 hour per day there and back. That means for every week we are in lockdown people will reclaim 5 hours that would have otherwise been spent stuck in their car.

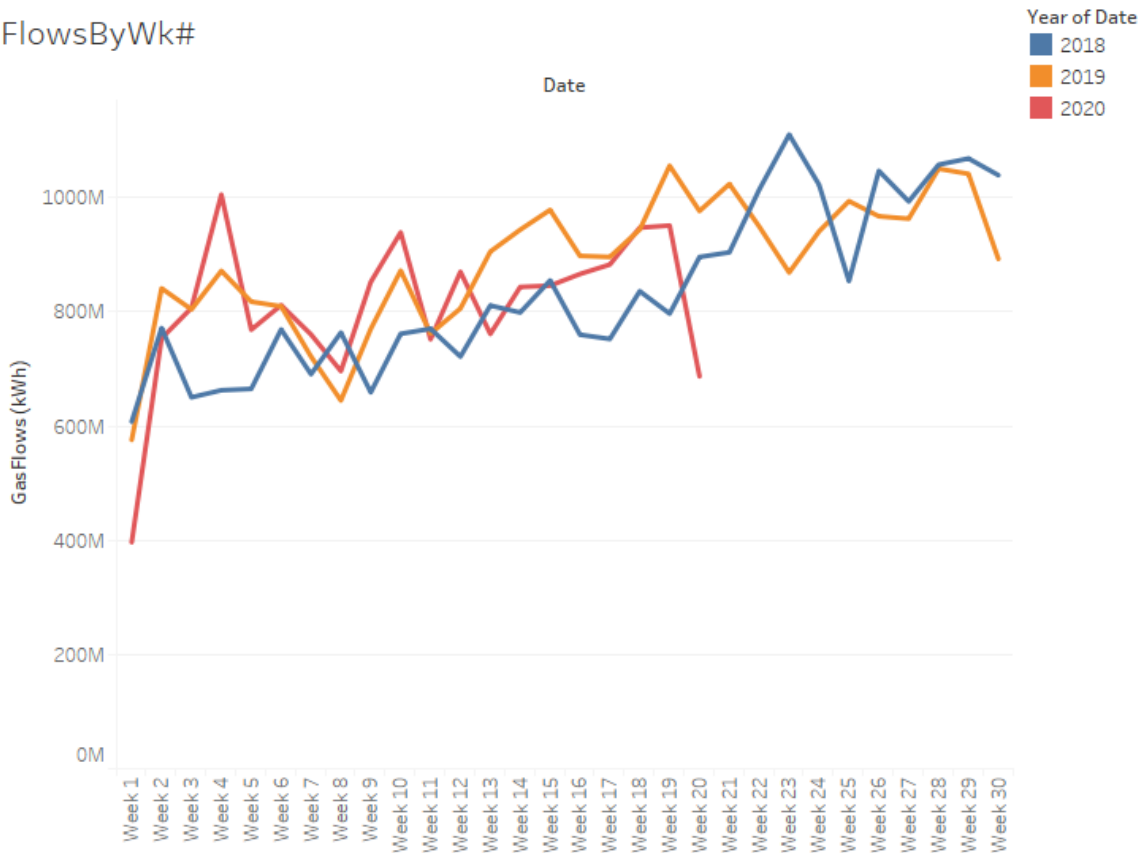


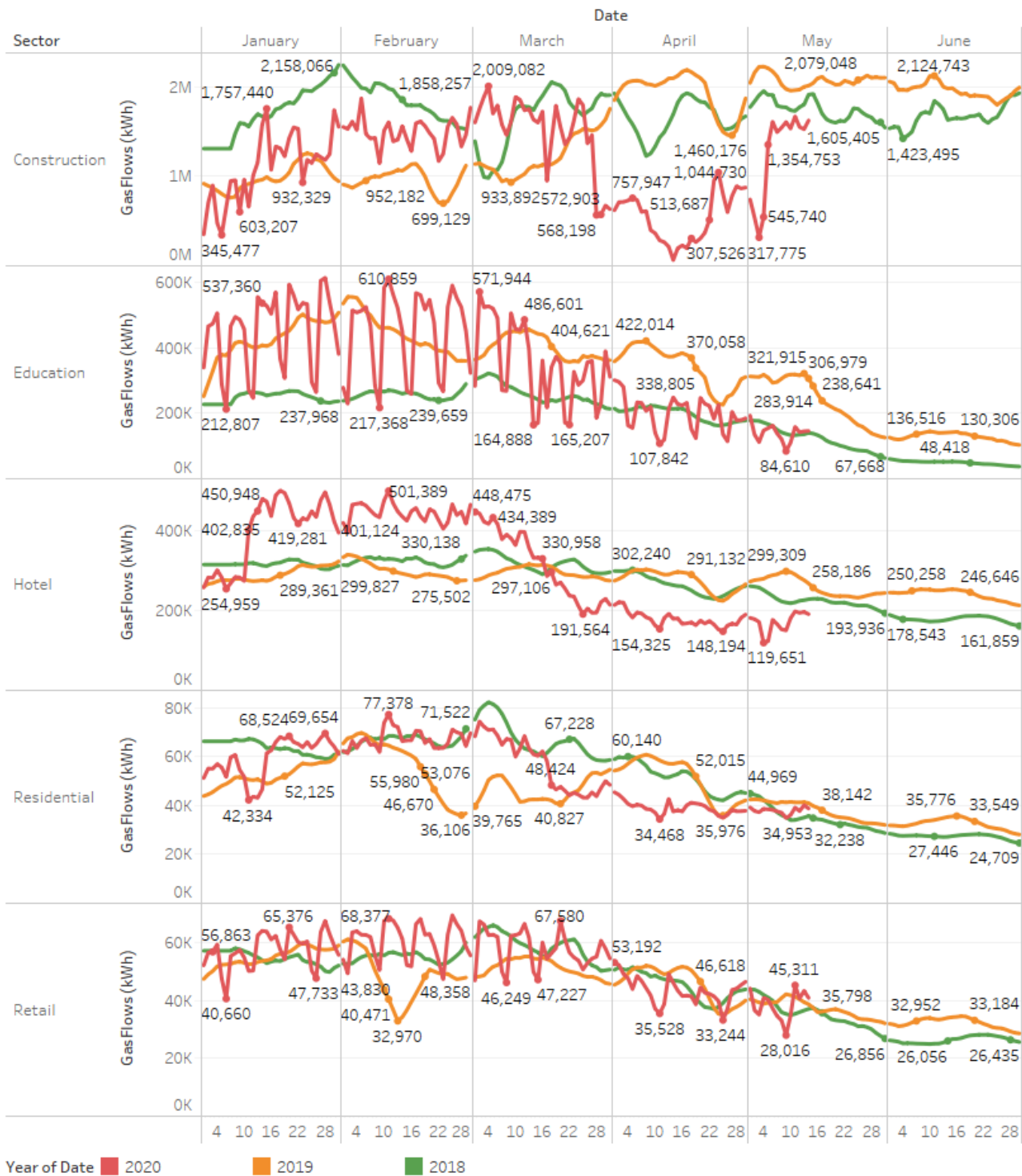
HEAT – Drop in industrial space heating will largely just be picked up at home

The other large user of energy in Ireland is from heat, both residential and industrial. During the lockdown most people are heating themselves at home rather than at work. Space heat demand is closely linked to the weather, and since it has been mild recently this will likely decrease emissions. However, Ireland's housing stock uses a lot of oil as well as solid fuels such as peat, coal and timber. These fuels are much more CO₂ intensive than electricity and natural gas, which is used in a lot of commercial premises. Peat, coal and timber are also among the main sources of hazardous local air pollution in Ireland. It is difficult to get real time coal, oil and peat consumption data because it is generally stockpiled or stored in tanks. We can see from gas flows within the pipelines that heat demand has dropped in the travel, leisure, office and education sectors, the largest drop in gas demand being in construction. There is a difference of 129GWh in gas flows compared to 2019 levels from week 10 to now. This equates approximately to a reduction of 28ktCO₂ over the past 10 weeks, and about 63ktCO₂ across all heat. Notably, in anticipation of a restart, construction heat consumption

(used in producing materials like cement) has increased in the last week. Education and office sector gas consumption has not fallen as dramatically as one might expect, while the buildings are at low occupancy, universities continue to consume large amounts of gas in their combined heat and power plants.

FlowsByWk#





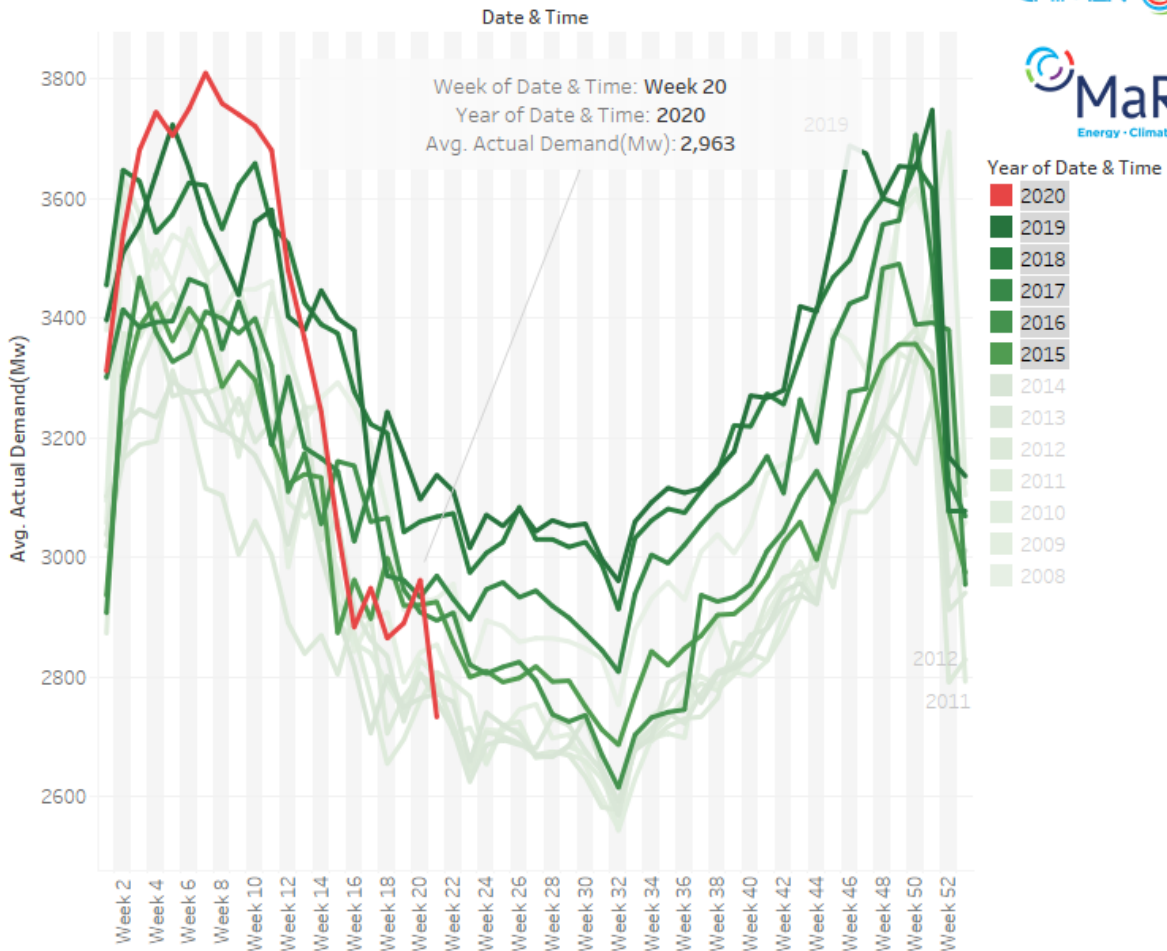
Electricity

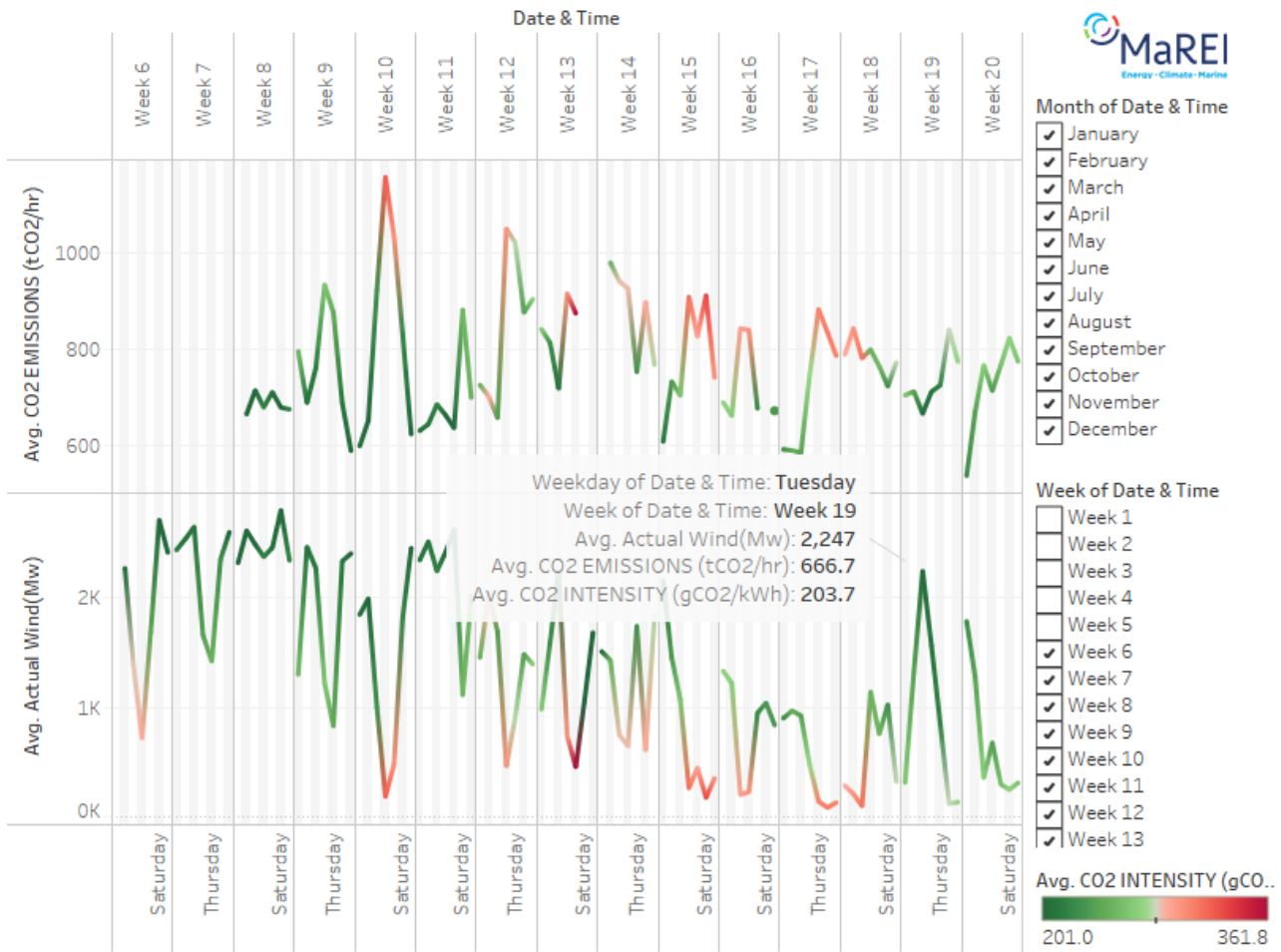
Electricity demand has gone down, but emissions remain the same over the past 3 months.

The electricity sector plays a perhaps the most critical role these days. In this time of remote work and virtual lockdown, electricity has become source of energy we rely on in aiding the executing remote office work, lighting, and entertainment. Overall demand for electricity though has seen a decrease of 5-10% over seasonal expectations since early March as a result of the COVID-19 measures. The changes in behaviour means we generate and consume electricity if it is a 7 day weekend. Not the sort of never ending weekend one would

hope for. Sources for the supply of electricity in Ireland include fossil fuels (gas, coal, peat and oil), renewables (wind, solar, biogas and hydro), electricity imported from Great Britain. The mix of fuels that is being used depends on the weather, how much electricity is available from renewable sources, as well as costs.

Irish Average Weekly Electricity Demand 2008-Present





So far the impact of COVID-19 hasn't caused an obvious change in the electricity generation fuel mix, the weather has a greater impact on the mix than the drop in demand. Mild weather has led to lower electricity generation from wind compared to the first weeks of March meaning other (mostly fossil fuel) producers to have filled the gap. A possible increase of wind in the coming weeks could give us valuable insights on how the electricity system might respond to larger relative shares of weather dependent renewables such as wind and solar, in line with emission reduction targets.

Air Pollution.

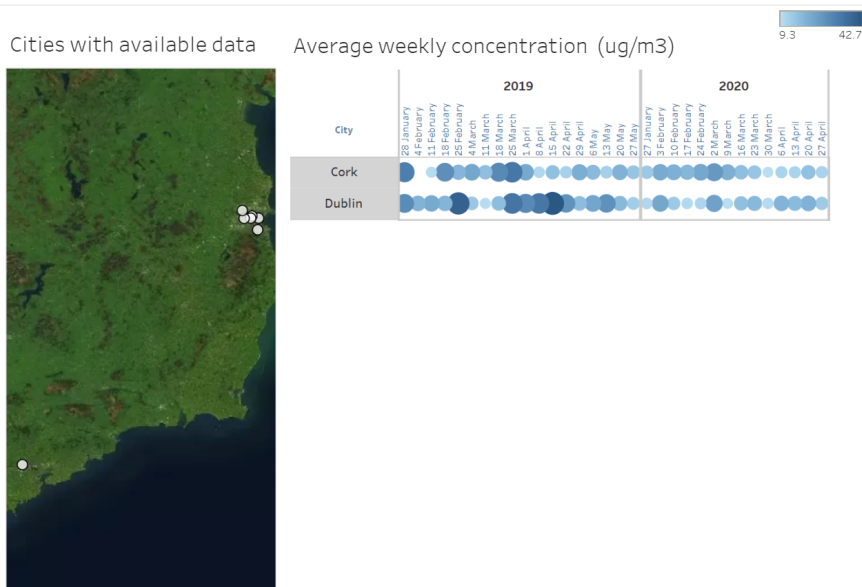
Impacts on air pollution during the pandemic

The World Health Organisation estimates that 1,500 deaths per year are attributable to outdoor air pollution in Ireland, that figure is 400,000 for Europe and 4.2million deaths globally. While it is early days, data suggests that local air pollution has been impacted significantly during this pandemic.

For example, a network of ground-based Data from The European Environment Agency's (EEA) member countries has shown us how concentrations of nitrogen dioxide (NO₂) — a pollutant mainly emitted by road transport and to a lesser extent electricity generation — have decreased in many European cities. NO₂ has been linked to increased levels of lung conditions ranging from asthma and bronchitis to respiratory-related hospital admissions and emergency room visits.

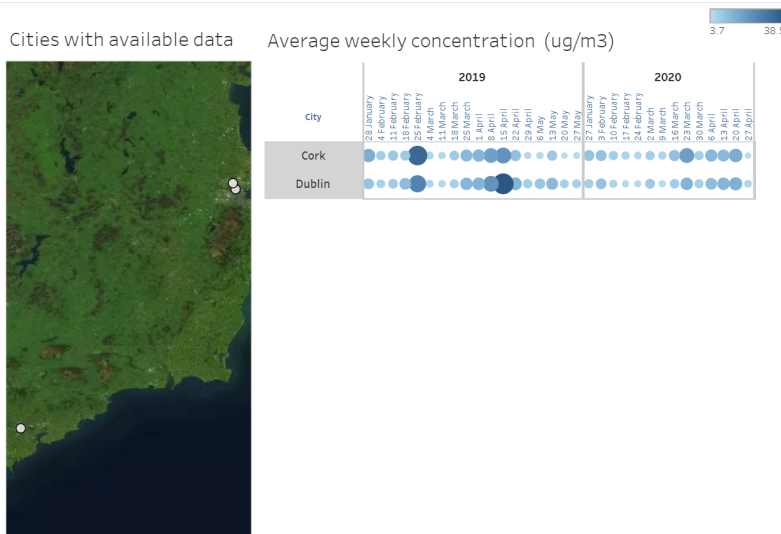
In Ireland the EPA have reported a decrease in NO₂ concentrations of up to 50% at many monitoring stations likely associated with the reduction in road traffic.

Data EEA: Dublin and Cork NO₂ Average Weekly Concentrations 2019 & 2020



However, there are many different types and sources of air pollution in Ireland and while the story has been good for transport related air pollution it is not so clear for others. Fine particulate matter (PM2.5) is tiny particles produced mainly from solid fuel burning (peat, coal and timber). PM2.5 is linked to increased incidence of respiratory and cardiovascular disease and higher death rates. The EPA Ireland have stated that currently, levels of air pollution in Ireland resulting from solid-fuel burning have not changed due to Covid-19 restrictions and are generally as expected for this time of year. NUI Galway’s AEROSOURCE network indicates similar trends with PM concentrations being typical for the season and conditions.

Data EEA: Dublin and Cork PM2.5 Average Weekly Concentrations 2019 & 2020



Factors such as weather conditions, may significantly contribute to the weekly reductions seen in pollutant concentrations and conversely, changes in meteorology can also lead to increased air pollution and coupled with the often-non-linear relationships between changes in emissions and changes in concentrations, also explain why lower air pollution may not occur at all locations. Ozone at ground level (not to be confused with ozone in the upper atmosphere) is formed by the reaction of pollutants including nitrogen oxides from vehicles with sunlight. Ozone is a major constituent of smog.

Excessive ozone in the air can have a marked effect on human health. It can cause breathing problems, trigger asthma, reduce lung function and cause lung diseases. Further atmospheric modelling studies will be needed to ingest the current data and to help understand the effect on secondary pollutant formation and ozone levels.

How will our behaviour change for COVID 19 influence our climate change mitigation ambition?



What we're seeing is a huge upheaval in how we are living our lives, which is having a massive impact on our carbon emissions, especially from transport. The oil market price is a typical indicator of the health of energy markets. The recent negative prices of crude oil in the USA is a double edged sword. Low oil prices will help accelerate the economic recovery, but unfortunately low or negative oil prices will also send the wrong signals for a green zero carbon recovery.

But is there cause to be optimistic that this will improve Ireland's efforts to combat climate change?

We need to make long-term, equitable and sustainable changes to our lifestyles, to our economy and to our energy system. But with hundreds of thousands of people without work, and only a small share of workers able to work from home in the long run, the current model is very unsustainable. Grandparents miss their grandchildren; office workers miss their colleagues.

The energy system CO₂ emissions reductions so far may be 3MtCO₂ in total, or 2MtCO₂ excluding aviation which would equate to roughly 5.3% less energy related CO₂ than last year so far.

Ultimately, what will matter is how we go back to business when life returns to normal. To make the big shifts in our energy system that are needed, people need to have money in their pocket and politicians need to go back to putting legally binding equitable carbon budget emissions limits into law as soon as possible, ideally yesterday. A complete lockdown scenario is only viable for short term, whereas climate change mitigation & adaptation is a marathon event requiring rapid and sustained steady changes in how we consume energy and live our lives.



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