**Climathon Challenge UGZ – additional information**

In the light of Covid19, some fundamental positive and negative shifts are apparent and ongoing. In the following, a selection of current studies on the consequences of Covid19 on different climate-relevant topics are presented.

**Travel**

With the lockdown, commuting and leisure trips for many millions of people came to an abrupt halt (Bert et al., 2020). Aloi et al. (2020) reveal an overall mobility fall of 76%. Therein, private car use is decreasing less than public transport, which dropped by 93% during lockdown measures. As Google and Spotify announced home-office policies until at least the end of 2020, these effects could be persistent. Nevertheless, after the lockdown measures, the use of bikes, e-scooters, walking, and private cars has increased as a mode of transportation. 60% of BCG's survey respondents said they were more likely to buy a car post-lockdown than they were before the crisis, mainly due to physical distance and cleanliness reasons. The BCG report shows a general increase of solo travel as 50% of respondents said they will be using public transport less frequently (Bert et al., 2020). Nonetheless, cities like Paris and Milan try to foster sustainable mobility. Paris plans to create 650 km of pop-up bike lanes and Milan announced ambitious schemes to reduce car-use after the lockdown (ibid.), thus increasing regional travel and commuting by bike.

Furthermore, Gössling, Scott, and Hall, 2020, state that international travel could decline by 20-30% relative to 2019. Even though international travel came to an immediate halt during lockdown in March 2020, Farand (2020) shows the side effects by stating that the offset of emissions growth in the aviation sector is eased until at least 2023.

**Energy supply**

The pandemic significantly affects the electricity and petroleum demand as well (Le Quéré, 2020; Norouzi et al., 2020), resulting in reduced fossil fuel consumption (Le Quéré, 2020; Myllyvirta & Thieriot, 2020). Disruptions in the use of jet fuel, gasoline, natural gas, coal are direct effects of Covid19. The largest reduction stemmed from gasoline usage at a scale of 15000 TJ/day (Gillingham et al., 2020). Electricity demand dropped quickly with confinement measures, too. It steadily recovered as measures were gradually softened; it was still 10% below 2019 levels in EU-countries in June. Electricity demand under lockdown measures was comparable to Sunday levels electricity usage, while the drastic reductions in services and industry only were partially offset by a higher residential use (IEA, 2020b).

As a result, clean energy should take a lead role in the global economic recovery (IEA, 2020a). According to a UN report (UN, 2020), renewable energy is more cost-effective than ever, providing an opportunity to prioritize clean energy in economic recovery packages and bring the world closer to meeting the Paris Agreement goals.

**Emissions**

While the short-term effects of the pandemic are rather clear, the long-run effects are highly uncertain, inter alia the impact of the pandemic on travel externalities. As transportation (air and ground) has stopped during lockdown measures, air pollution reduced more drastically the more severely countries were affected by the virus (Liu et al., 2020). Since nitrogen dioxide is primarly emitted from fossil fuel burning, it is a good indicator of economic activities. NASA pictures show a 48% drop in tropospheric nitrogen dioxide compared to 2019 averaged over the 20 days before lunar new year to the 20 days after (ibid.). Furthermore, NO2 pollution fell as much as 60% compared to the monthly average in 2019 in big metropoles, e.g. New York (Villar, 2020).

Additionally, daily global CO2 emissions decreased by 17% by early April 2020 compared to the mean 2019 level, with just less than half of the changes coming from surface transport (Le Quéré et al., 2020). Le Quéré et al. (ibid.) expect the impact on the annual CO2 emissions to depend on the duration of the confinement and estimate the impact to range from -4% to -7%.

Forster et al. (2020) estimate the direct effect of the pandemic driven climate response to be negligible, compared to a baseline scenario that follows current national policies. Nonetheless, the authors expect the temperature anomaly to decrease by 0.3 degrees by 2050 as a result of economic recovery strategies tilting towards green investments and reductions in fossil fuel investments. Hepburn et al. (2020), too, expect the short-term reductions in GHG emissions resulting from lockdowns to have minor long-terms effects unless they facilitate deeper and longer-term human, business, and institutional changes. Le Quéré et al. (2020) even expect pollution levels to return to their original level when the coronavirus ebbs.

**Nutrition**

As Covid19 was transmitted from a pangolin or a bat to humans in a market of the city of Wuhan (Andersen et al., 2020), Nasi and Fa (2020) suggest a decrease in consumption of meat, similar to the effects of the Ebola outbreak in West Africa in 2014 (Pooley, Fa, and Nasi, 2015). As the nutritional status of individuals has for long been considered an indicator of resilience against destabilization, the pandemic is expected to increase awareness in nutrition. Inadequate nutrition can lead to long-lasting effects that are linked to health. Poor diet quality has been associated not only with physical but also mental health. Thus, the pandemic is expected to increase regional and healthy nutrition and local food accessibility (Naja & Hamadeh, 2020).

**Deforestation**

The pandemic lead to a surge in agricultural expansion and illegal mining, which increased deforestation in Brazil and Colombia (Price, 2020).

**Recycling and Reuse**

Over the years, awareness about single-use plastic has increased but the pandemic has reversed the mindset of humanity. The monthly global use of facemasks and gloves is 129 billion and 65 billion, respectively (Prata et al., 2020). These are neither recycled nor reused (Saumweber et al., 2020)

**Policy**

Imminent fiscal recovery packages could entrench or partly displace the current fossil-fuel-intensive economic system. Green fiscal recovery packages can act to decouple economic growth from GHG emissions. This is reinforced by the pandemic in the short-term and climate change in the long-term (Hepburn et al., 2020). Furthermore, rapid de-carbonization calls for unprecedented policy initiatives and investments. Clear long-term objectives, combined with targeted public investment and appropriate market incentives, will enable the private sector to adopt swiftly to climate change (Espinosa & La Camera, 2020). The ultimate goal should be to "build back better" from the pandemic in a way that confronts the climate crisis and fosters green investments (Kasriel, 2020).

Nevertheless, the question of how sustainable these effects are in the long term has yet to be investigated. Furthermore, the estimations are highly uncertain, e.g. the accuracy of climate agents is biased as data gathering by Aircraft Meteorological Data Relay (AMDAR) was lost during pandemic since most airplanes were grounded.

**References**

Aloi, A., Alonso, B., Benavente, J., Cordera, R., Echániz, E., González, F., ... & Perrucci, L. (2020). Effects of the COVID-19 Lockdown on Urban Mobility: Empirical Evidence from the City of Santander (Spain). Sustainability, 12(9), 3870.

Andersen, K. G., Rambaut, A., Lipkin, W. I., Holmes, E. C., & Garry, R. F. (2020). The proximal origin of SARS-CoV-2. Nature medicine, 26(4), 450-452.

Bert, J., Schellong, D., Hagenmaier, M., Hornstein, D., Wegscheider, A. K., & Palme, T. (2020, June 16). How COVID-19 Will Shape Urban Mobility. https://www.bcg.com/publications/ 2020/how -covid-19-will-shape-urban-mobility.

Espinosa, P., & La Camera, F. (2020, May 14). Now is the Time to Build a 21st Century Energy System. https://unfccc.int/news/now-is-the-time-to-build-a-21st-century-energy-system.

Farand, C. (2020, July 1). Airlines’ climate obligations postponed as UN body endorses industry proposal. https://www.climatechangenews.com/2020/07/01/airlines-climate-obligations-postponed-un-body-endorses-industry-proposal/#:~:text=Airlines'%20climate%20 obligations%20postponed%20as%20UN%20body%20endorses%20industry%20proposal,-Published%20on%2001&text=Airlines%20have%20wriggled%20out%20of,weaken%20the%20sector's%20climate%20deal.

Gillingham, K. T., Knittel, C. R., Li, J., Ovaere, M., & Reguant, M. (2020). The Short-run and Long-run Effects of Covid-19 on Energy and the Environment. Joule, 4(7), 1337-1341.

Gössling, S., Scott, D., & Hall, C. M. (2020). Pandemics, tourism and global change: a rapid assessment of COVID-19. Journal of Sustainable Tourism, 1-20.

Hepburn, C., O’Callaghan, B., Stern, N., Stiglitz, J., & Zenghelis, D. (2020). Will COVID-19 fiscal recovery packages accelerate or retard progress on climate change?. Oxford Review of Economic Policy, 36.

IEA. (2020a, April 24). IEA and Denmark host ministerial roundtable discussion on making clean energy a key part of the global economic recovery. https://www.iea.org/news/iea-and-denmark-host-ministerial-roundtable-discussion-on-making-clean-energy-a-key-part-of-the-gl obal-economic-recovery?utm\_content=buffer7dd40&utm\_medium=social&utm\_source=twitte r-ieabirol&utm\_campaign=buffer.

IEA. (2020b, August 1). Covid-19 impact on electricity. [report]. https://www.iea.org/reports/covid-19-impact-on-electricity.

Kasriel, E. (2020, June 25). Has the pandemic helped individuals and leaders get any closer to tackling the environmental crisis?. https://www.bbc.com/future/article/20200624-has-covid-19-brought-us-closer-to-stopping-climate-change

Le Quéré, C., Jackson, R. B., Jones, M. W., Smith, A. J., Abernethy, S., Andrew, R. M., ... & Friedlingstein, P. (2020). Temporary reduction in daily global CO 2 emissions during the COVID-19 forced confinement. Nature Climate Change, 1-7.

Liu, F., Page, A., Strode, S. A., Yoshida, Y., Choi, S., Zheng, B., ... & Veefkind, P. (2020). Abrupt decline in tropospheric nitrogen dioxide over China after the outbreak of COVID-19. Science Advances, eabc2992.

Myllyvirta, L., & Thieriot, H. (2020). 11,000 air pollution-related deaths avoided in Europe as coal, oil consumption plummet. Available in: https://energyandcleanair. org/wp/wp-content/uploads/2020/04/CREA-Europe-COVID-impacts. pdf.

Naja, F., & Hamadeh, R. (2020). Nutrition amid the COVID-19 pandemic: a multi-level framework for action. European Journal of Clinical Nutrition, 1-5.

Nasi, R., & Fa, J. (2020, March 30). COVID-19-led ban on wild meat could take protein off the table for millions of forest dwellers [Blog Post]. https://forestsnews.cifor.org/64855/covid-19-led-ban-on-wild-meat-could-take-protein-off-the-table-for-millions-of-forest-dwellers?fnl=en.

Norouzi, N., de Rubens, G. Z., Choubanpishehzafar, S., & Enevoldsen, P. (2020). When pandemics impact economies and climate change: Exploring the impacts of COVID-19 on oil and electricity demand in China. Energy Research & Social Science, 68, 101654.

Pooley, S., Fa, J. E., & Nasi, R. (2015). No conservation silver lining to Ebola. Conservation Biology, 29(3), 965-967.

Prata, J. C., Silva, A. L., Walker, T. R., Duarte, A. C., & Rocha-Santos, T. (2020). COVID-19 pandemic repercussions on the use and management of plastics. Environmental Science & Technology, 54(13), 7760-7765.

Price, K. (2020, April 30). Poaching, deforestation reportedly on the rise since COVID-19 lockdowns. [blog post]. https://www.conservation.org/blog/poaching-deforestation-reportedly-on-the-rise-since-covid-19-lockdowns.

Saumweber, W., Lehr, A. K., Loft, T., & Kim, S. (2020, April 10). Covid-19 at Sea: Impacts on the Blue Economy, Ocean Health, and Ocean Security. https://www.csis.org/analysis/covid-19-sea-impacts-blue-economy-ocean-health-and-ocean-security.

UN. Environment Programme. (2020, June 10). Falling clean energy costs provide opportunity to boost climate action in COVID-19 recovery. [press release]. https://www.unenvironment.org/news-and-stories/press-release/falling-clean-energy-costs-provide-opportunity-boost-climate-action

Villar, F. (2020, April 15). Coronavirus: lockdown’s effect on air pollution provides rare glimpse of low-carbon future [blog post]. https://theconversation.com/coronavirus-lockdowns-effect-on-air-pollution-provides-rare-glimpse-of-low-carbon-future-134685.