Abstract for the General Public

The interlinkage of temperature-energy-pollution.

Empirical evidence from Poland.

Goal:

The increasing temperatures observed around the world from year to year pose a potential threat on the safety and reliability of the Polish energy system. The following project studies the effects of a heatwave that occurred in Poland in August of 2015, which forced government to reduce the energy produced by coal power plants (by over 15%) in the attempt to prevent a power outage. It aims to answer several research questions: How does an increase in temperature affect the likelihood/number of a mechanical failure at the plant level, and ultimately a power outage? How did this forced reduction in energy produced by the coal power plants affect the Polish energy sector? For how long was it destabilized? Did this natural experiment affect the air pollution level? Was the decrease long-lasting? Did the pollution decrease in the areas that are densely populated? To study those research questions, I plan to use novel high frequency micro data, which is a substantial contribution in itself. However, the research questions themselves are novel and policy relevant, and the project will result in valuable policy implications especially for Polish energy security.

Motivation:

The structure of Polish electricity production has traditionally been dependent on hard coal and lignite and continues to be (24% lignite and 48% of hard coal in 2020). Unsurprisingly then, 50% of all greenhouse emissions in Poland come from the energy sector. Coal power plants use also substantial amounts of water at a daily level - estimated up to 70% of Polish daily water demand. The following project considers the need of Poland to reduce the air pollution and investigates the *temperature-energy-air-pollution interlinkage*. It calculates the economic costs arising from a sudden energy sector inefficiency. More importantly, it introduces and investigates a new important argument in the debate. In the standard literature on pollution, the main argument against the coal power plants relies mainly on pollution levels that they create and natural resource depletion. However, there is another commonly ignored problem that will surely become increasingly pressing as we face the climate change and rising temperatures – namely – dependence on water. This paper addresses that gap in the literature.

Description of research:

It is no coincidence that in 2021 the Noble Prize in Economics went to three economists for their methodological contributions to the analysis of causal relationships. Causal inference has never been better and made significant progress in estimating causal effects both in and outside of laboratory. The following paper draws on the methodologies established by the laureates to arrive at causal estimates of the variables of interest using a natural experiment (a heatwave and the sudden regulation). To that aim we will use novel high frequency micro data (plant, hourly level), and recent developments in applied economics such as using wind direction as an instrumental variable to estimate the effect on air-pollution.

Results expected:

We expect to show that heatwaves reduce the efficiency of coal power generation and increase generation outages. The mechanism is through increase in water temperature and decrease in water supply that lends the water supply unsuitable or insufficient, respectively, for use in power generation. We will estimate the welfare costs by conducting alternative policy scenarios and will rely on comparing costs of generation within Poland to prices of imported power from outside Poland. Lastly, we expect to find out that the regulation created a temporary reduction in pollution levels, however, this result was not long-lasting and not in the densely populated areas.