
해외출장 보고서

17th Conference on Energy Economics and Technology 및 Kiel Institute workshop on the role of public research and innovation measures on mitigating climate change

참석 결과 보고

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출장 개요

- 출장자: 부교수 김영재
- 출장기간: 2023. 5.4–5.14 (11일간)
- 출장지: 독일 Dresden & Kiel
- 출장목적:

1. 17th Conference on Energy Economics and Technology 참석 (Technische Universität Dresden)

- o 논문 발표: Effects of fuel switching on electricity consumption and greenhouse gas emissions after the Russia–Ukraine War” (발표자료 첨부 2 & 학회 일정 첨부 3참조 & 학회 참가증 4 참조)

*교내 연구과제 중간 발표 (공동저자인 Prof. Seong-Hoon Cho (University of Tennessee) 및 Kyonggi Min (KDI School) 대표하여 논문의 기초 분석 결과 발표 후 피드백 받고자 참석

2. Kiel Institute Workshop on the role of public research and innovation measures on mitigating climate change

- o 논문 발표: International and intertemporal knowledge spillovers in carbon-free and carbon-efficient technologies
(발표 자료 첨부 5 & 학회 일정 첨부 6 참조)
- o 관심세션 참석, 최근 연구동향 파악, 학회 참석자들과의 연구 교류, 연구정보 수집 등
- o 항공료의 낭비를 막기 위해서 두 군데 학회를 한 번의 비행으로 참석
(기타 간담회 일정 아래 표 1 참조)

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활동 내용

1. 논문 발표

1.1 “Short-term effects of the energy crisis caused by the Russia-Ukraine War on Europe’s energy transition toward carbon neutrality”

Summary:

Russia’s invasion of Ukraine in February 2022 has exacerbated the global supply chain that had already been strained by the U.S.-China trade conflict and pandemic-related disruptions. Virtually all regions worldwide have experienced soaring energy prices, accelerating global inflation. Europe has been hardest hit, having historically depended on Russian gas. This unexpected disruption has pushed some European governments such as Germany and Italy to ration hot water and electricity to reduce natural gas consumption during the summer of 2022 (Hughes, 2022; Wallace, 2022). Moreover, Europe’s efforts for energy transition toward carbon neutrality have been further tested

as Russia cut its supply of natural gas to Europe not long after the war started. Since the war's inception, the European Union (EU) and its members have been implementing measures that may cause imminent slow down or even reversal in progress toward energy transition. For example, Germany's Economy Minister Rober Habeck announced that Germany will increase the usage of coal to compensate for a cut in Russian gas (Meredith, 2022).

Understanding whether the war is affecting deviation from the EU's original energy transition goals is critical for potentially shifting strategies to achieve climate neutrality by 2050 through mainstreaming energy transition (Siddi, 2023). Thus, in this research, we examine the short-term effects of the energy crisis caused by the Russia-Ukraine War on Europe's energy transition toward carbon neutrality. As a case study, we forecast electricity supply from nuclear, coal, natural gas, hydro, and renewables in Germany and Italy with and without the effects of war. Germany and Italy are chosen for the case study as they are two European countries whose major energy consumption have been heavily dependent on Russian gas (Bella et al., 2022). We compare short-term forecasts of electricity supply from the five energy sources and resulting impacts on carbon emissions with and without the war effect in these two countries separately, allowing us to understand the war's future impact on energy transition to carbon neutrality.

Our approach consists of three steps. First, we employ a time series model (i.e., ARIMA model) to construct the model best fit for forecasting electricity supply of each of the five energy sources for Germany and Italy independently. Second, we forecast electricity supply from each energy source for 2022-2027 based on the ARIMA model using historical data of 2017-2021 without the effect of the war in 2022 and compare with corresponding forecasts for 2023-2027 based on the ARIMA model using historical data of 2017-2021 with the effect of the war in 2022 in each country. Third, the predicted electricity supply in 2022-2027 without the war in 2022 and the predicted electricity supply in 2023-2027 with the war in 2022 are converted to carbon dioxide (CO₂) emissions based on CO₂ conversion factors.

Our preliminary findings are as follows. In Germany, gas-fired power plants used to generate electricity prior to the Russia-Ukraine War have been replaced by a return to coal-fired power plant operations, causing an increase in carbon emissions. This finding

suggests that the country is likely to face a greater burden to achieve climate neutrality by 2050. Conversely, Italy continues to rely heavily on gas-fired power plants, suggesting the effect of war on the country's original course of energy transition is not as pronounced as that of Germany. The findings offer valuable information for potentially shifting strategies to achieve climate neutrality by 2050 through mainstreaming energy transition in Europe.

1.2 “International and intertemporal knowledge spillovers in carbon-free and carbon-efficient technologies”

Summary:

This paper contributes to the knowledge diffusion literature and energy and climate modelling community by updating the estimation of the role of barriers to knowledge diffusion in carbon-free and carbon-efficient technologies in a sample of 29 countries including fast-growing economies over the period 1990-2015. Our results provide a more nuanced picture than previous analyses [3]. First, we confirm that geographical, linguistic, economic and technological barriers have a different effect on carbon-free as opposed to carbon-efficient knowledge generation. Furthermore, their importance changes over time: the hindering effect of geographical distance, language and economic barriers decreases over time, in line with results from the most recent trade literature [41]. We confirm that knowledge flows are higher in countries with similar technological profiles; this is particularly true for carbon-free technologies, which are less mature. Our analysis does not support the conjecture that distance in policy space reduces the probability of knowledge flows.

We use our empirical results to generate knowledge spillover parameters across countries for 1990-2002 and 2003-2015. We show that international knowledge spillovers increased in intensity, as compared to domestic spillovers, for carbon-free technologies in the latest years. This is true in most countries in our sample, including those which showed no benefits from international knowledge flows in the first half of our sample. The opposite is true for carbon-efficient technologies.

Our findings confirm that knowledge spillovers have a technology-specific role, and that they are not static over time. Note that the estimated diffusion parameters increased over time, particularly over the last decades in carbon-free technologies. Ignoring this fact would lead to an underestimation of innovation in integrated assessment frameworks. This suggests that the contribution of knowledge spillovers to further knowledge generation has increased. Overall, this could lower the costs associated with meeting stringent environmental targets because it favors innovation in low carbon technology options. Given their important role knowledge spillovers play in promoting further innovation to lower the costs of climate mitigation, low-decarbonization pathways should account for this specificities. The diffusion parameters we compute can thus be fruitfully employed for the calibration of integrated assessment knowledge with endogenous, country- or region-specific knowledge production functions.

3. 관심세션 참석, 최근 연구동향 파악, 학회 참석자들과의 연구 교류, 연구 정보 수집 등

- 학회 중 원자력 발전에 대가인 에너지경제학자 Prof. Christian Von Hirschhausen, TU Berlin)을 만나 추후 학교 행사에 섭외 할 수 있도록 함
- 천연가스 시장과 관련해서 아시아의 시장성이 성장할 것이라고 보는 Prof. Anne Neumann (NTNU) 교수님도 면담 함
- 폴란드 AGH University of Science and Technology 의 Prof. Artur Wyrwa 교수님은 KSP 사업에 관심이 많아, 추후 가능성 탐진 해 볼 예정

- 환경 혁신 경제학 분야의 대가인 Prof. Giovanni Marin 교수님을 만나 현재 진행 중인 연구를 발전시켜 추가 공동 연구 진행 가능성 탐진
- World Bank의 Prof. Carolyn Fischer 교수님을 만나 뵙고 내년도 환경/에너지 관련 세미나에 초청 여부 가능성 탐진

표 1. 여행 일정

월일 (요일)	출발지	도착지	방문기관	업무수행내용	접촉예정인물 (직책포함)
2023.5.5	Dresden	Dresden	Technische Universität Dresden	학회 참석	
2023.5.6	Dresden	Dresden	Technische Universität Dresden	간담회 참석	Prof. Christian Von Hirschhausen Prof. Anne Neumann Prof. Artur Wyrwa
2023.5.9	Kiel	Kiel	Kiel Institute	간담회 참석	Prof. Giovanni Marin
2023.5.10	Kiel	Kiel	Kiel Institute	간담회 참석	Prof. Carolyn Fischer
2023.5.11	Kiel	Kiel	Kiel Institute	학회 참석	
2023.5.12	Kiel	Kiel	Kiel Institute	학회 참석	

