

AKE 6: Intermittent Renewable Energy Supply

Time: Monday 16:45–17:45

Location: U A-Esch 1

Invited Talk

AKE 6.1 Mon 16:45 U A-Esch 1

Decarbonization of the European energy system with strong sector couplings — KUN ZHU¹, MARTA VICTORIA¹, TOM BROWN², GORM B. ANDRESEN¹, and •MARTIN GREINER¹ — ¹Department of Engineering, Aarhus University — ²Institute for Automation and Applied Informatics, Karlsruhe Institute of Technology

Ambitious targets for renewable energy and CO₂ taxation both represent political instruments for decarbonization of the energy system. We model a high number of coupled electricity and heating systems, where the primary sources of CO₂ neutral energy are from variable renewable energy sources (VRES). The model includes hourly dispatch of all technologies for a full year for every country in Europe. The amount of renewable energy and the level of CO₂ tax are fixed exogenously, while the cost-optimal composition of energy generation, conversion, transmission and storage technologies and the corresponding CO₂ emissions are calculated. Even for high penetrations of VRES, a significant CO₂ tax of more than 100 EUR/tCO₂ is required to limit the combined CO₂ emissions from the sectors to less than 5% of 1990 levels, because curtailment of VRES, combustion of fossil fuels and inefficient conversion technologies are economically favored despite the presence of abundant VRES. A sufficiently high CO₂ tax results in the more efficient use of VRES by means of heat pumps and hot water storage, in particular. We conclude that a renewable energy target on its own is not sufficient; in addition, a CO₂ tax is required to decarbonize the electricity and heating sectors and incentivize the least cost combination of flexible and efficient energy conversion and storage.

AKE 6.2 Mon 17:15 U A-Esch 1

Geometric optimization of wind farms based on minimization of the Coulomb energy — JOAKIM TRANE, ERIK B. JOERGENSEN, and •MARTIN GREINER — Department of Engineering, Aarhus University

Within a constrained wind-farm area, the wind turbines need to have

sufficient spacing, so that the wind is able to recover in between the turbines. In this respect, wind turbines can be treated in analogy to equally charged particles, which arrange to have largest possible distances by minimizing the total Coulomb energy. This objective leads to a much faster spatial optimization of wind farms when compared to layout optimizations with dedicated engineering wind-farm models. For isotropic wind roses, the resulting Coulomb layouts lead to an increase of the wind-farm power efficiency by about 10% when compared to standard grid-like layouts. A further generalization of this optimization analogy to non-isotropic two-particle Coulomb interactions is also discussed and demonstrated to successfully deal with non-isotropic wind roses.

AKE 6.3 Mon 17:30 U A-Esch 1

Von der Grundlastdeckung zur Lückenlastdeckung — •HELMUT ALT — Eichelhäherweg 6, 52078 Aachen

Bei aller Euphorie, unsere Energieversorgung im Rahmen der politisch verordneten Zielvorgaben der "Energiewende" auf eine Stromerzeugungsbasis mit 100 % regenerativer Primärenergie umrüsten zu können, mögen einige Fakten aus der realen Bedarfsdeckung im Bereich der öffentlichen Stromversorgung Beachtung finden, um kostenbelastende Fehlentwicklungen zu vermeiden. Inzwischen treten die Wirkungen der als Panikreaktion auf die Fukushima-Katastrophe singulär in Deutschland gesetzten unsinnigen Zielsetzungen der politisch doch sehr hastig verordneten Energiewende hinsichtlich des überbordenden Ausbaus der fluktuierenden regenerativen Primärenergieträger mittels Wind- und Sonnenanlagen zur Deckung des deutschen Strombedarfes immer deutlicher zu Tage: Über 25 Mrd. € jährliche EEG Belastung! Es ist Daher angezeigt, in Demut zu ergründen, was geht und was unter bezahlbaren Randbedingungen nicht geht, um eine effiziente Weiterentwicklung der Energiewende mit realistische Zielsetzungen auf gangbaren Wegen zu ermöglichen nach dem Motto: "Das Bessere ist der Feind des Guten, aber was gestern gut war, muss auch heute noch brauchbar sein".