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Air quality and future energy system planning

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Ambient air pollution has been linked to an increasing number of premature deaths throughout the world. Projected increases in demand for food, energy resources and manufactured products will likely contribute to exacerbate air pollution with an increasing impact on human health, agricultural productivity and climate change. Current events such as tampering emissions tests by VW car manufacturers, failure to comply with EU Air Quality directives and WHO guidelines by many EU countries, the problem of smog in Chinese cities and new industrial emissions regulations represent unique challenges but also opportunities for regulators, local authorities and industry. However current models and practices of energy and resource use do not consider ambient air impacts as an integral part of the planing process. Furthermore the analysis of drivers, sources and impacts of air pollution is often fragmented, difficult to understand and lacks effective visualization tools that bring all of these components together.
This work aims to develop a model that links impacts of air quality on human health and ecosystems to current and future developments in the energy system, industrial and agricultural activity and patterns of land use. The model will be added to the ForeseerTM tool, which is an integrated resource analysis platform that has been developed at the University of Cambridge initially with funding from BP and more recently through the EPSRC funded Whole Systems Energy Modeling (WholeSEM) project. The basis of the tool is a set of linked physical models for energy, water and land, including the technologies that are used to transform these resources into final services such as housing, food, transport and household goods. The new air quality model will explore different feedback effects between energy, land and atmospheric systems with the overarching goal of supporting better communication about the drivers of air quality and to incorporate concerns about air quality into energy system planning. Some example applications of this work are: (1) to discover conflicts and synergies between air quality regulations and future developments in the energy system and land use change; (2) to show the drivers of air quality in a given spatial context; (3) to explore effective ways to visualize impacts of different energy, land use and emissions control policies on air quality.
An initial test case for the Bay Area in California will be presented, extending the scope of the existing California ForeseerTM tool to identify impacts of different policies within the water-energy-land nexus on local air quality.