Book

Smoked out: the health hazards of burning coal

Coal is humanity's second oldest fuel. Like the oldest biomass, coal has had a defining role in human history. The control of biomass fire defined the transition of becoming human nearly 2 million years ago and control of coal was the driver of the first industrial revolution some 250 years ago. Along with the agricultural revolution, these were arguably among the most important milestones of our species.

Although oil, gas, and other fuels now have major roles in our energy use, the burning of biomass and coal has never declined in absolute terms. It was not until the last third of the 20th century that use of biomass and coal together fell below half of our total usage, and today they supply more than a third of our primary energy needs. And both are still mostly burned in raw form with relatively little processing. These two fuels also share another characteristic: they create by far the most important health effects from human energy use.

The Silent Epidemic: Coal and the Hidden Threat to Health by Alan Lockwood provides a well-researched and accessible discussion of the wide range of health risks from modern use of coal. Mining and transporting the vast tonnage of coal used worldwide creates significant hazards, both to workers and the public, but it is air pollution from coal burning that most threatens health. Although emissions of mercury and other toxic constituents in coal pose risks to health, it is the more conventional kinds of air pollution that are thought to create the largest health burdens in terms of heart and respiratory diseases. Of the air pollutants from coal burning, the major killer seems to be exposure to small particles (particulate matter smaller than 2·5 μm in aerodynamic diameter). Lockwood provides an excellent non-technical explanation of the toxicology and physiological effects of small particulate matter. His account will be useful to any health scientist who has tried to make the transition from the epidemiology of the health effects of exposure to particulate matter, which is highly convincing to most observers, to respond to the inevitable question from a non-specialist about how inhaling small particles might cause heart disease, stroke, adverse pregnancy outcomes, IQ loss, and perhaps even diabetes. Admittedly, these disease effects seem a far cry from the more intuitive direct effects on the respiratory system.

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This book was written before the release of two major international assessments that bolster its conclusions. The 2012 Global Energy Assessment underlines the continued impacts of coal and biomass for health, climate, and worker safety and the need to come to grips with them if a sustainable society is to be achieved. The Global Burden of Disease Study 2010 (GBD 2010) updates estimates for the effect of outdoor air pollution on health to more than 3 million premature deaths worldwide in 2010, substantially greater than the estimates available to Lockwood. More than 1 million of these deaths are estimated to occur in China alone, much because of coal.

Not all outdoor air pollution is due to coal combustion or even energy use, and a gap in the new assessments is that they have not yet well documented the contributions to pollution by fuel and economic sector. It is clear, however, that fuel combustion has the largest role in outdoor emissions and, among fuels, coal is worst. Even knowing relative emissions, however, does not translate directly to relative health impacts because large emissions from a remote power station, for example, might not be as damaging to health as much smaller emissions emitted close to people in a neighbourhood. Somebody has to breathe it first, a concept called intake fraction—ie, the proportion of the amount emitted actually taken in by the population.

In this context, a disappointment of Lockwood's book is that he does not address the unhealthiest use of coal in the world—the one with the highest intake fraction. Hundreds of millions of people still use unprocessed coal for household cooking and space heating in simple stoves. In GBD 2010, household air pollution from solid cooking fuels is estimated to be responsible for 3·5 million premature deaths in 2010, with about half a million more due to the outdoor air pollution created by these household fuels. Despite long awareness of coal's impacts in households, it is surprising how recently household use of coal has been banned in modern societies. Dublin only did so in the 1990s, for example, with major demonstrated health benefits. China has only recently done so in cities, but household coal use is still widespread in rural areas.

As concluded by Lockwood, although coal pollution is generally much more controlled than in the past, better knowledge of its effects and the continued rise in energy demand make efforts both to push for even cleaner coal combustion and to make major shifts to alternatives priorities. There is reason, however, to ban household use of coal everywhere now.

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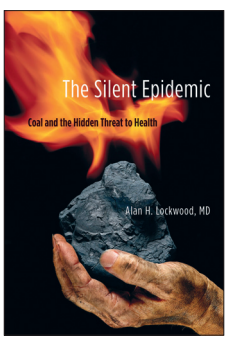

The Silent Epidemic: Coal and the Hidden Threat to Health
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For the **Global Energy Assessment: Toward a Sustainable Future** see http://www.iiasa.ac.at/web/home/research/Flagship-Projects/Global-Energy-Assessment/Home-GEA.en.html

For **Global Burden of Disease Study 2010** see *Lancet* 2012; **380:** 2224–60. http://www.thelancet.com/themed/global-burden-of-disease