Scientists see urgent need for reducing emissions

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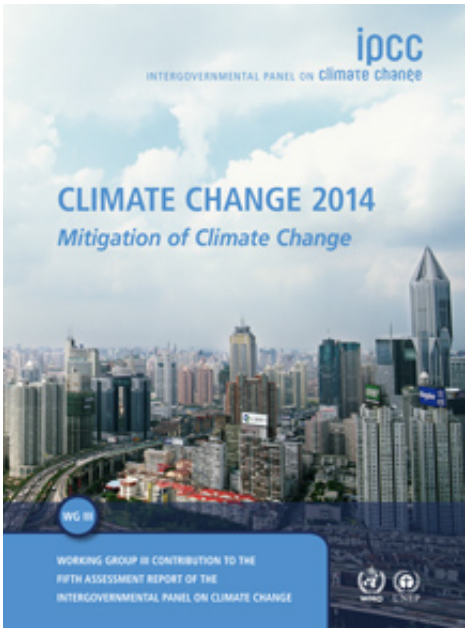

(Phys.org) —The bad news: a major transformation of our current energy supply system is needed in order to avoid a dangerous increase in global temperatures. The good news: the technologies needed to get there are mostly readily available. These are some of the main conclusions reached by experts from Lawrence Berkeley National Laboratory (Berkeley Lab) and their Working Group III co-authors on the Fifth Assessment Report of the U.N. Intergovernmental Panel on Climate Change (IPCC).

"If there are no controls in place—and in the U.S. we need stronger controls—then global temperatures could increase around 4.5 degrees Celsius. That's high enough to melt the polar ice caps," said Berkeley Lab scientist Jayant Sathaye, who has worked on IPCC assessment reports since 1990. "If that happens higher temperatures will become dangerous."

Sathaye, who served as a review editor on one of the chapters as well as lead reviewer on nine overall summaries, said carbon dioxide emissions have risen more rapidly in the last decade and the atmospheric CO_2 concentration now stands at about 400 parts per million (ppm). "If we can hold the CO_2 concentration to between 430 to 480 ppm until 2100, then temperatures won't increase all that much, maybe by 1.5 degrees Celsius, which would not be a huge impact."

Besides Sathaye, six Berkeley Lab scientists served as lead authors or contributing authors on Working Group III's contribution to the IPCC report, which focuses on mitigating climate change. Most of them also worked on the Fourth Assessment Report, released in 2007, which shared the Nobel Peace Prize with Al Gore.

More renewable energy needed

Ryan Wiser, an expert on renewable energy sources and a lead author on the chapter on energy supply, said a significant transformation in the energy supply system is needed to not exceed a 2-degree Celsius temperature increase over pre-industrial times, a target that almost 200 countries committed to in 2010.

"The rapid decarbonization of the electricity supply is found to be particularly important. To limit the temperature increase to 2 degrees Celsius requires that the share of low-carbon supply reach approximately 80 percent by 2050, and fossil fuel power generation without carbon

capture and storage to be phased out almost entirely by 2100," Wiser said.

To reach these deep reductions in greenhouse gas emissions, power plants would have to turn to renewable sources such as wind, solar, and biomass or to nuclear energy, or burn fossil fuels with carbon capture and storage, a process that has not yet been commercially applied in the electricity sector, Wiser said. "The resources are available to get us to those pathways. Deployment of renewable technologies has grown enormously since the last assessment report, and costs have declined substantially," he said. "But we don't find any evidence that technology advancements alone will be capable of achieving decarbonization. Policy intervention is a necessary element of the game."

Buildings have huge potential for energy savings

One area with huge potential for emissions reductions is in buildings. While this is not a new finding, the latest IPCC report identified several opportunities for large energy savings, said Berkeley Lab scientist Ashok Gadgil, who was a lead author on the chapter. "Currently most of the building performance standards are met at the design stage, and then we say bye-bye," he said. "We can't do that. We have to make sure buildings actually perform the way they're designed."

One solution is to recommission buildings more frequently, which means making sure that all components of the building are performing as designed. Currently buildings are recommissioned after 20 to 30 years, but systems and components start to degrade after three years, said Gadgil, who is also head of the Lab's Environmental Energy Technologies Division.

For new buildings, there are also cost-effective ways to reduce energy consumption. "For a roughly 10 percent increase in first-time costs, you

can reduce energy consumption by about 40 percent," Gadgil said. "The investment would go towards better systems and higher-grade components, such as thermally insulating windows. For a building in, say, Houston, that would let in less heat, which would allow you to put in smaller chillers and air-conditioning units, thus compensating for the higher cost of better windows."

Industry is largest emitter

Another major emitter of climate-warming gases with large potential for savings is the industrial sector. Industry accounts for 40 percent of energy-related emissions, and globally, industrial emissions are dominated by Asia, said Lynn Price, a lead author of the chapter and also the head of Berkeley Lab's China Energy Group.

"The growth is really from China—China is now the largest energy consumer and greenhouse gas emitter," Price said. "To get where we need to go, industries need to adopt an 'all of the above' strategy and reduce emissions through multiple means."

While the last IPCC report focused on how industry could become more energy efficient, Price said that industrial growth has surpassed efficiency gains, so this report examined further opportunities for savings. "Cost-effective energy efficiency technologies and measures still exist and represent potential savings of about 25 percent," she said. "If you look beyond those measures and look at material efficiency, demand reduction, and fuel switching, you can get additional savings."

Berkeley Lab researchers Ali Hasanbeigi contributed to the understanding of costs and potentials in the industry chapter and Stephane de la Rue Du Can contributed to the industry and buildings chapters, providing important information on the indirect emissions associated with electricity and heat consumption in these sectors.

Looking at the carbon footprint of cities

A new chapter in this IPCC report looked at the effect of cities, and how elements such as density, the location of infrastructure, spatial planning, and transit design can be used to lower a city's carbon footprint. Cities are important because more than half of the world's population lives in urban areas, and that number could grow to nearly 70 percent of the population by 2050.

"The bottom line is, there are large opportunities for mitigation in conjunction with sustainable development," said James McMahon, a Berkeley Lab researcher and lead author on the chapter.

One of their findings was that comprehensive spatial planning on multiple scales—from the regional all the way down to neighborhoods and streets—so that infrastructure, transport, and land use systems work together is the key to sustainability. Many cities around the world have already come up with their own climate plans to reduce greenhouse gas emissions.

"I'm encouraged by the local efforts we saw," McMahon said. "At a time when information can be shared around the world very quickly, having a few cities in different locations come up with plans so any other city can learn from them creates much more rapid progress."

Provided by Lawrence Berkeley National Laboratory