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ACM Technology Policy Council Releases TechBrief on Computing and Carbon Emissions

New York, NY, October 28, 2021 – The Association for Computing Machinery's global Technology Policy Council (ACM TPC) today released "ACM TechBrief: Computing and Climate Change," a concise report outlining the energy consumed by the information and communication technology (ICT) sector and the climate impacts of the carbon emissions resulting from that energy consumption. One of the report's key findings is that computing can help mitigate climate change but must first cease contributing to it.

The TechBrief is the first in a series of short technical bulletins by ACM TPC that present scientifically-grounded perspectives on the impact of specific developments or applications of technology. Designed to complement ACM's activities in the policy arena, the primary goal is to inform rather than advocate for specific policies. Topics under consideration for future TechBriefs include facial recognition, election security, smart cities, and encryption, among others.

The report points out that most analysts estimate that between 1.8% and 3.9% of global carbon emissions are attributable to information and communication technologies (ICT) activities. This makes the ICT sector's carbon footprint comparable to, and by some estimates higher than, that of the aviation sector. And most worryingly of all, at a time when all sectors across the global economy are being told to reduce carbon emissions, computing's carbon footprint is steadily growing.

The ACM TPC believes that now is an opportune time to release a report on this topic, as the energy demands of computing have grown exponentially in recent years. For example, the report notes that datacenters worldwide now use twice as much of the total global electricity supply as they did just 10 years ago. In particular, the "computational overhead" (resources needed to perform operations) for artificial intelligence applications increased an estimated 300,000 times between 2012 and 2018. Recent research indicates that the ICT sector may be responsible for one-third of global carbon emissions by 2050 if it does not decease carbon emissions in line with other sectors' pace of reductions.

"Climate change is one of the most significant issues of our time, and this also makes it a significant issue for computing," explains Bran Knowles, a Senior Lecturer at Lancaster University's Data Science Institute and lead author of the TechBrief. "The public is generally aware that computing uses a great deal of

energy and that energy consumption contributes to climate change. But general understanding of this relationship is vague, and the impacts are greatly underestimated. Metaphors such as 'the cloud' hide the very real material consequences of digital technologies, and just because computing can deliver efficiency gains, this does not mean that computing necessarily saves more carbon than it emits. Our report seeks to draw attention to the extent to which computing is contributing to climate change and lay out some potential first steps for reducing that impact. We call for uniform standards to measure the scale of carbon emissions caused by the ICT industry, and we also advocate for coordinated, clear and enforceable governmental policies and law to reduce ICT sector carbon emissions."

The report recognizes the current limitations in how carbon emissions resulting from the ICT sector are measured. For one, computing solutions are embedded into other sectors, and separating out computing's footprint can be challenging. For example, many estimates of the sector's footprint do not include emissions related to embedded devices, machine-to-machine communication, or cryptocurrencies. There are also indirect impacts to contend with, including rebound effects, where efficiency reduces energy consumption in the short term but spurs greater energy demand.

The report also notes that research and initiatives to improve energy efficiency have become a sub-specialty of computing and that bodies such as the UN and European Commission have set ambitious goals for reduced emissions from computing technologies. But the report warns that increased computing efficiency alone is unlikely to reduce the ICT sector's own emissions, and that additional measures must be taken to ensure that the sector is able to meet these goals.

"As the world's largest organization of computing professionals, ACM has the convening power to catalyze a conversation about the relationship between information technology and carbon emissions," added James Hendler, Professor at Rensselaer Polytechnic Institute and Chair of the ACM TPC. "In this initial report, we've included several important statistics which frame the scope of the problem and set some initial goals for how we must measure the impact of our field on carbon emissions. We hope that the delegates to the 2021 United Nations Climate Change Conference (COP 26) and policy makers the world over find it both alarming and immediately useful."

About the ACM Technology Policy Council

ACM's global Technology Policy Council sets the agenda for ACM's global policy activities and serves as the central convening point for ACM's interactions with government organizations, the computing community, and the public in all matters of public policy related to computing and information technology. The Council's members are drawn from ACM's global membership. It coordinates the activities of ACM's regional technology policy groups and sets the agenda for global initiatives to address evolving technology policy issues.

About ACM

ACM, the Association for Computing Machinery, is the world's largest educational and scientific computing society, uniting computing educators, researchers and professionals to inspire dialogue, share resources and address the field's challenges. ACM strengthens the computing profession's collective voice through strong leadership, promotion of the highest standards, and recognition of technical excellence. ACM supports the professional growth of its members by providing opportunities for life-long learning, career development, and professional networking.

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