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GLOBAL ENERGY TRANSITIONS AND THE CHALLENGE OF CLIMATE CHANGE

Abstract

Global emissions of greenhouse-gases have increased markedly as a result of human activities since pre-industrial times. This increase in emissions has lead to unequivocal global warming, which is evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level.

Reducing the risk of irreversible climate impacts requires thus the mitigation of global GHG emissions aiming at the long-term stabilization of atmospheric GHG concentrations. Achieving this goal translates into the need of reducing emissions to virtually zero over long time-frames. Yet international agreement on a long-term climate policy target remains a distant prospect, due to both scientific uncertainty and political disagreement on the appropriate balance between mitigation costs and reduced risks of dangerous impacts. At the same time, growing emissions of greenhouse gases continue to increase the amount of climate change we are committed to over the long term. Over the next few decades, these growing emissions may make some potentially desirable long term goals unattainable.

Recent analysis conducted at IIASA indicates the need of major energy transitions over the next few decades. For example, staying below the target suggested by the European Union of 2 C warming (with just a 50% likelihood) will require the massive deployment of zero-carbon energy by 2050, and a tippling of the contribution of zero-carbon energy globally to more than 60% by that time. Although there are large uncertainties with respect to the deployment of individual future technologies, there is strong evidence that no single mitigation measure alone would be sufficient for achieving the stabilization of GHG concentrations at low levels. A wide portfolio of technologies across all GHG-intensive sectors is needed for cost-effective emissions reductions. The bulk of these emissions reductions would need to come from the energy sector, with the forest and agricultural sectors playing an important role for the cost-effectiveness. Energy-related measures range from energy conservation and efficiency improvements to shifts away from carbon-intensive coal to cleaner fuels (such as natural gas, renewables, and nuclear), as well as “add-on” technologies such as carbon capture and storage. Other important measures include changes in agricultural practices to reduce CH_4 and N_2O emissions, and enhancement of terrestrial sink activities in the forest sector.

Reducing the risks of climate change significantly, requires fundamental structural changes of the energy system in the long term, combined with accelerated technology diffusion and early investments over the next few decades. In addition, appropriate and effective investment incentives need to be in place for development, acquisition, transfer, and deployment of new technologies. Achieving a trend-reversal of presently declining trends of R&D expenditures in environmentally friendly energy technologies will thus be central for addressing the climate change challenge.

GLOBALNA ENERGETSKA TRANZICIJA I IZAZOVI KLIMATSKIH PROMJENA

Sažetak

Ljudskim aktivnostima izazvane globalne emisije stakleničkih plinova izrazito su povećane u odnosu na predindustrijsko razdoblje. Takvo povećanje emisija dovelo je do globalnog zatopljenja koje se očituje u povećanju prosječnih globalnih temperatura zraka i oceana, sve većem topljenju snijega i leda i povećanju prosječne globalne razine mora.

Stoga, ublažavanje rizika kojeg nose nepovratne promjene klime zahtijeva smanjivanje globalnih emisija stakleničkih plinova koje bi bilo usmjereno na dugoročnu stabilizaciju njihovih koncentracija u atmosferi. Postavljanje ovog cilja znači zapravo potrebu za smanjenjem emisija na doslovce nulte razine tijekom dugog vremenskog razdoblja. Međutim, međunarodni sporazum koji bi definirao ciljeve politike klime još je uvijek daleko, ili zbog znanstvenih neizvjesnosti ili zbog političkih neslaganja o pravoj ravnoteži između troškova smanjenja emisija i snižavanja rizika ugrožavajućih utjecaja. Istodobno, sve veće emisije stakleničkih plinova nastavljaju proizvoditi sve snažniji utjecaj na klimu s kojim se moramo suočiti u dugom vremenskom razdoblju. Tijekom nekoliko sljedećih desetljeća sve veće emisije bi mogle neke poželjne dugoročne ciljeve učiniti neostvarivim.

Nedavna analiza koju je načinio Međunarodni institut za analize primijenjenih sustava (IIASA) ukazuje na potrebu da se u narednih nekoliko desetljeća izvedu velike energetske tranzicije. Na primjer, ukoliko se želi zadržati emisije ispod ciljane razine što predlaže Europska unija (s 50% vjerojatnosti) potrebno je do 2050. godine uvesti u široku uporabu energiju bez ugljika, i postupno globalno povećanje udjela neugljične energije na preko 60 posto. Iako postoje velike neizvjesnosti u pogledu primjene pojedinačnih budućih tehnologija, postoje jaki dokazi da niti jedna pojedinačna mjera smanjenja emisija sama za sebe neće biti dovoljna za postizanje stabilnosti niskih koncentracija stakleničkih plinova. Potrebno je uvesti široku lepezu tehnologija u svim sektorima koji su veliki proizvođači stakleničkih plinova radi ekonomične redukcije emisija. Veliki dio ovih redukcija bit će potrebno izvesti u samom energetskom sektoru, kao i u sektorima šumarstva i poljoprivrede, gdje ekonomičnost smanjenja emisija mora biti važna. Raspon energetskih mjera ide od štednje energije i povećanja učinkovitosti do supstitucije ugljena čistijim gorivima (kao što su prirodni plin, obnovljivi izvori, i nuklearna energija), kao i uvođenja tehnologija hvatanja i skladištenja ugljika. Ostale važne mjere uključuju promjene poljoprivrednih tehnika radi smanjenja emisija CH_4 i N_2O i razvijanje aktivnosti na zemnom apsorbiranju ugljika u sektoru šumarstva.

Značajno ublažavanje opasnosti klimatskih promjena zahtjeva fundamentalne strukturne dugoročne promjene energetskog sustava uz istovremeno ubrzanje širenja tehnologija i pravovremenih ulaganja u nekoliko idućih desetljeća. Osim toga, potrebni su i odgovarajući poticaji ulaganjima radi razvijanja, stjecanja, prijenosa i primjene novih tehnologija. Stoga će preokret u sadašnjem trendu opadanja troškova za istraživanje i razvoj u ekološki zdrave energetske tehnologije biti važan čimbenik za suočavanje s izazovom klimatskih promjena.