Global Energy and Climate Outlook: Road to Paris - Assessment of Low Emission Levels under World Action Integrating National Contributions

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ABSTRACT

Under the UN Framework Convention on Climate Change (UNFCCC), 194 countries took decisions in Copenhagen, Cancun, Durban and Doha in 2009-2012 to act on climate change: notably, all agreed to aim for the common goal to limit global temperature rise to below 2°C compared to pre-industrial levels; more than 90 countries took mitigation commitments until 2020; the Green Climate Fund was established with developed countries agreeing to mobilise US$ 100 billion private and public finance by 2020 for climate action.

This paper presents the impact of global climate change mitigation policies on the energy system and on the economy. The analyses combine the economic model GEM-E3 and the energy systems model POLES and focus on possible ways to deliver such global effort to stay below 2°C through processes established in the run-up to Paris COP21. The simulations study a combination of domestically determined mitigation targets for the period beyond 2020 inspired by the 2°C objectives, differentiated according to national capabilities and based on the most recent estimates of the effects of the current pre2020 pledges and policies. This paper also explores how a framework of international collaboration could enhance further the domestic mitigation contributions.

The GEM-E3 model is a recursive dynamic computable general equilibrium model which covers the interactions between the economy, the energy system and the environment. The model is calibrated to the 2004 base year of the GTAP 8 database. The data is aggregated to 21 sectors (of which 3 energy resource sectors and 7 energy intensive sectors), and complemented with 10 power technologies. The global version of the GEM-E3 model is disaggregated to 25 regions, including the EU, the USA, Canada, Brazil, China, India, Japan, Australia, New Zealand and Russia. The remaining countries are aggregated into regional groups. The six Kyoto greenhouse gasses represented are CO2, SF6, PFC, HFC, CH4, and N2O.

The POLES model is a global sectoral simulation model for the development of energy markets. It operates on a yearly basis up to 2050, with a very recent data update. Main exogenous inputs are economic growth and demographic projections for each region. POLES provides comprehensive energy balances (demand, transformation, and supply) for the 57 countries / regions covering the world and detailed oil and gas productions for 80 countries. Energy demand in 15 sectors is driven by income and derived activity variables as well as short- and long-term energy prices.

The GEM-E3 model and POLES model share a harmonised Baseline with the population and economic growth projections based on the UN and OECD, respectively. According to these common macro-economic assumptions, growth is sustained in all regions with the average GDP per capita tripling in the period 2010-2050 and remaining differences amongst regions. The strong growth in countries with low-income levels in 2010 enables them to join middle-income levels by 2050. This baseline also includes the effects of the current pre2020 mitigation pledges on global emission levels up to 2050, without new additional policies by 2020 or beyond. It also represents the evolution of the energy markets, as driven by its own dynamic of production, supply and demand. This representation is consistent with IEA projections. The projections do not consider the impacts from unabated climate change. In this Baseline scenario, global emissions would increase at unsustainable levels: from 48 GtCO2e in 2010, 61 GtCO2e in 2030 to 68 GtCO2e in 2050. Along such trajectories, the world is at risk to experience a global temperature increase of +4°C, with sizeable impacts on sustainable growth and vulnerable groups in all regions.

We develop here a Global Action scenario whose 2010-2050 GHG emission budget is consistent with a medium or likely chance to meet the long-term goal of a maximum 2˚C increase in temperature over pre-industrial levels, while reflecting the need for a global transition towards low-emission economic development. At about 43 GtCO2e in 2030, World GHG emissions are still higher than in 1990 (+20%) but lower than in 2010 (-10%).

The modelling confirms that all regions can define domestic mitigation goals in line with 2°C, based on their current policy experiences, and that the institutions and mechanisms put in place under the Climate Convention framework can be mobilised to deliver enhanced climate and economic benefits, especially for the countries with less capabilities. A significant transformation of the energy system is required, including energy savings, decarbonising the power sector with renewables, nuclear and fuel switching and actions to cut non-CO2 emissions in agriculture, industry or waste.

The GEM-E3 model is used to assess the macro-economic and competitiveness effects of the Global Action scenario. The effects analysed include GDP, sector activity, exports and imports, employment, private consumption and welfare. The results indicate that climate change mitigation policies only marginally reduce the economic growth rates in fast-growing low-income regions. Another dimension of the analysis is the choice of policy instruments. For this purpose, we compare the use of free allocation of permits with an increasing use of auctioning or taxation. The revenues are recycled as an income subsidy to the consumers, a reduction in the social security contributions or a reduction of taxation on consumption and investment. The results illustrate that countries can minimise the costs for their economies by tailoring the implementation of their international commitments to their national circumstances.