


Executive summary

In L'Aquila, Italy on 9 July 2009, 17 heads of industrialised and non-industrialised countries participating in the Major Economies Forum on Energy and Climate set a clear goal for international climate policy: the increase in global temperature above pre-industrial levels ought not to exceed 2°C. This implies that global greenhouse gas (GHG) emissions should peak soon and fall below half current emission levels by the middle of this century. Yet the reality is that existing policy efforts would not prevent energy-related CO₂ emissions from rising for decades to come.

Electricity at the core of the climate stabilisation challenge

Lowering global CO₂ emissions to address climate change requires nothing short of an energy revolution. Electricity, because it is mostly generated from fossil fuels, is at the core of this challenge. It accounts today for more than 40% of global energy-related CO₂ emissions and its emissions will grow by 58% globally by 2030 unless new policy measures are introduced. Many OECD member countries have started implementing ambitious policies to guide electricity generation and uses on the path to lower emissions – CO₂ pricing through cap-and-trade, support for renewable and nuclear energy, subsidies for the deployment of breakthrough technologies such as carbon capture and storage (CCS), and a range of energy efficiency policies.

This issue of electricity-related CO₂ emissions is, however, most pressing for developing countries, where electricity demand growth is particularly high. If these countries invest in conventional CO₂-emitting generation capacity, there is a serious risk of so-called “carbon lock-in”, as power plants are used over decades. According to the IEA *World Energy Outlook 2008* scenarios, unchecked growth in fossil fuel-based electricity outside the

OECD region could lead to a doubling of emissions by 2030. Electricity-related emissions in developing countries would then be equivalent to half of the level of global emissions required to stay on track with stabilisation of GHG concentrations at 450 ppm of CO₂ equivalent – the 450 Policy Scenario in *WEO 2008*. In other words, without additional measures, CO₂ emissions from electricity in non-OECD countries would make it impossible to keep the world on a sustainable climate path. Any global strategy to fight climate change must make the electricity sector a priority for action, with developed countries taking a strategic role in helping developing countries establish new, more effective approaches to emission mitigation.

This publication examines the issue of electricity and climate change in developing countries, with a focus on the next two decades. It is framed by the current debate on sectoral approaches (SAs), put forward in the negotiations of the UN Framework Convention on Climate Change (UNFCCC). A sectoral approach assumes that while some developing countries may not be in a position to adopt a comprehensive, legally-binding emission objective in the coming phase, they may commit certain sectors to ambitious GHG emission mitigation. Sectoral approaches of various types have been proposed by Parties to the UNFCCC. These include: sector-specific objectives for developing countries; new market mechanisms based on sectoral crediting or sectoral caps; and international support for sharing best technology and best policy practice in priority sectors.

A two-tiered approach to curbing CO₂ from electricity in emerging economies

An effective strategy to curb CO₂ from electricity rests on three pillars:

- Significant improvements in the energy efficiency of electricity end-uses, which will alleviate the pressure on building more capacity in the next two decades. Most of these improvements can be of a

win-win-win nature – reaping benefits for energy security, economic performance and the environment.

- Policy incentives to move towards a decarbonisation of power supply, which will come at additional cost, either through a price on CO₂ emissions or subsidies for the deployment of low-carbon technologies not yet competitive with fossil fuel-based generation.
- Enhanced R&D in low-carbon generation technologies, a critical element for the long-term response. This publication addresses only the first two pillars.¹

The cost of decarbonisation is such that unmanaged electricity demand growth would greatly undermine our economic ability to introduce low-carbon generation technologies at scale. Ambitious energy efficiency policies are essential to deliver a less costly transition to a different, more expensive power supply system.

A positive point is that we are not starting from scratch in these policy areas: the international policy framework includes measures that have achieved a degree of success in moving towards reducing electricity emissions. The Kyoto Protocol's Clean Development Mechanism (CDM) has encouraged the deployment of some clean generation technologies on a project-by-project basis, but has had limited effects on the efficiency of plants globally. The CDM has shown less success in the area of end-use energy efficiency.

There is, thus, clearly a need for the international community to shift to a higher gear in supporting energy efficiency in developing countries. This is an area of possible mutual interest in developed and developing countries, given the benefits from energy security, energy cost savings, economic performance, reducing local pollution, and lowering CO₂ emissions. As an example, the retrofitting of coal-based power generation units that operate at conversion efficiency levels much lower than their original design should be a priority for a least-cost strategy. The IEA

1. See IEA (2008d), *Energy Technology Perspectives*, for a presentation of technology solutions for long-term mitigation strategies, including in power generation.

made practical recommendations on this front in its report to the G8 in Hokkaido, which could be endorsed by the climate community.

A two-tiered international approach is recommended. On the demand side, urgent policy support is needed in energy efficiency. On the supply side, strong economic signals are needed to encourage low-CO₂ generation technologies, from high efficiency plants to renewables, nuclear and CCS. Market mechanisms, if acceptable, would bring economic benefits by ensuring a least-cost mitigation effort.

Sectoral market mechanisms: a radical departure from CDM

Under sectoral market mechanisms, credits for emission reductions would be issued once a country reports performance that exceeds an agreed sectoral emission objective, the so-called baseline. Baselines would differ across countries, especially for power generation, reflecting the fact that generation fuel mixes, resources and access to technology still differ greatly from region to region.

The crediting of sector-wide CO₂ reductions in electricity needs to address some issues raised by CDM, however. The Kyoto Protocol's CDM helps to lower the cost of compliance with emission targets of developed countries; however, it is a zero-sum game for the environment. Credits from CDM projects are mere offsets for emissions in countries whose GHG emissions are above target. Crediting all reductions on a sectoral basis is not politically acceptable as it would require more ambitious goals for developed countries, only to be achieved by more offsets: developed countries would still carry the full burden of global mitigation. To be politically plausible, crediting on a sectoral basis will, therefore, require setting ambitious emission baselines in order to deliver global CO₂ abatement, and to ensure that the supply of credits does not overwhelm demand. Developing countries would first reduce emissions to meet the baseline – their contribution to global mitigation – and only be credited for reductions that surpass the baseline.

This book proposes design options for electricity baselines that would meet the above concerns and requirements, and could facilitate negotiations over ambitious baselines. Baselines could, for instance, evolve during the crediting period to reflect the improved performance of new plants.

A key message is that sectoral crediting will require a robust energy policy framework to create actual incentives for investors in the electricity sector in countries. An agreement to a baseline at sectoral level will not be enough to drive change at plant level – one company's effort to reduce emissions may be annihilated by other companies' failure to reduce their own. In light of this barrier, the carbon finance community must start working with electricity policy makers in developing countries to determine how sectoral mechanisms can effectively send a carbon price signal to investors in power generation.

This represents a sea-change from the CDM, in which investors could seek credit revenues at the level of an individual project. Sectoral crediting would lead to the issuance of credits for performance aggregated at country level. One possibility, although not politically attractive for many developing countries, is the introduction of domestic cap-and-trade systems as means to exceed the sectoral baseline. An enforceable cap on emissions, with emission allowances to domestic sources and a price on CO₂, would encourage change at the level of individual sources. These domestic systems could pave the way for a global carbon price in the future, via the linking of regional emissions trading systems.

Within the sectoral approach, technology deployment goals are also proposed as commitments for which developing countries could seek international assistance, and which could also contribute to meeting a sector baseline. Care should be taken to ensure that the targeted technologies do not lock countries into irreversible choices, and undermine a least-cost mitigation strategy. In light of policy experience in all these areas, the sharing of best policy practice ought to be a mutual priority for both developed and developing country governments.

The two-tiered approach to curbing CO₂ from electricity in emerging economies can be summarised as follows. Energy efficiency measures would be best supported by targeted policy assistance. Developing countries' generally high interest in this area, and the important local benefits, should make carbon credits superfluous. The carbon market ought to focus on more expensive mitigation options, in generation, for which change will require a premium on carbon reductions. In the case of electricity, this two-tiered approach can help to maximise abatement at least cost for the international community.

Existing policy efforts as stepping stones

In seeking to support additional action in developing countries, the international community needs a sound basis of information on ongoing and planned efforts. This book considers four countries from this standpoint: China, India, South Africa and Mexico (an OECD member country). Without the introduction of additional measures, all would experience considerable growth in CO₂ emissions from electricity generation in the coming decades. While all have national climate change plans, not all translate their efforts in country-wide emission schedules. The IEA *World Energy Outlook 2009* will shed further light on this, with possible country roadmaps for climate policy in major emerging economies.

The case studies in this book provide a wide-ranging policy experience, both on end-use and generation. Policies in place or envisioned cover a broad range, from voluntary agreements with industry to standard energy efficiency measures, energy-service companies, various support for renewables (including with CDM contribution), and technology goals. In the case of Mexico, efforts include a plan for a multi-sectoral CO₂ cap-and-trade system. The case studies also highlight some gaps that would need to be addressed if countries were to pledge sector-level goals to the UNFCCC. These gaps include: regulatory frameworks

and incentives to maximise and maintain plant efficiency; national-level data for electricity production and CO₂; and the role of local governments in relaying national policies.

Identifying policy needs and agreeing on support measures will require an extensive dialogue between developed and developing countries, and the formulation of sound energy and climate strategies in the latter. South Africa has completed such a multi-stakeholder national process to explore the country's strategies to fight climate change, an exercise that could be usefully replicated by other countries. Beyond such processes to elaborate national strategies, there is also a need to identify and promote best practice in energy and climate policies and to provide advice to countries seeking to increase their efforts in this area. Such work is underway in a number of industry and government fora, also described in this book.

Regardless of whether or not sector-specific discussions are brought to the table of the UNFCCC by the next climate policy framework, electricity generation and end-use should be priority areas for climate stabilisation. An expert group on electricity and climate should be established to monitor international progress on decarbonising generation and curbing demand growth, and to indicate areas where improvement is necessary. The IEA is ready to contribute its expertise to this important task.