



International  
Energy Agency

# REDRAWING THE ENERGY-CLIMATE MAP

## EXECUTIVE SUMMARY

World Energy Outlook Special Report

## INTERNATIONAL ENERGY AGENCY

The International Energy Agency (IEA), an autonomous agency, was established in November 1974. Its primary mandate was – and is – two-fold: to promote energy security amongst its member countries through collective response to physical disruptions in oil supply, and provide authoritative research and analysis on ways to ensure reliable, affordable and clean energy for its 28 member countries and beyond. The IEA carries out a comprehensive programme of energy co-operation among its member countries, each of which is obliged to hold oil stocks equivalent to 90 days of its net imports. The Agency's aims include the following objectives:

- Secure member countries' access to reliable and ample supplies of all forms of energy; in particular, through maintaining effective emergency response capabilities in case of oil supply disruptions.
- Promote sustainable energy policies that spur economic growth and environmental protection in a global context – particularly in terms of reducing greenhouse-gas emissions that contribute to climate change.
- Improve transparency of international markets through collection and analysis of energy data.
- Support global collaboration on energy technology to secure future energy supplies and mitigate their environmental impact, including through improved energy efficiency and development and deployment of low-carbon technologies.
- Find solutions to global energy challenges through engagement and dialogue with non-member countries, industry, international organisations and other stakeholders.

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**The world is not on track to meet the target agreed by governments to limit the long-term rise in the average global temperature to 2 degrees Celsius (°C).** Global greenhouse-gas emissions are increasing rapidly and, in May 2013, carbon-dioxide (CO<sub>2</sub>) levels in the atmosphere exceeded 400 parts per million for the first time in several hundred millennia. The weight of scientific analysis tells us that our climate is already changing and that we should expect extreme weather events (such as storms, floods and heat waves) to become more frequent and intense, as well as increasing global temperatures and rising sea levels. Policies that have been implemented, or are now being pursued, suggest that the long-term average temperature increase is more likely to be between 3.6 °C and 5.3 °C (compared with pre-industrial levels), with most of the increase occurring this century. While global action is not yet sufficient to limit the global temperature rise to 2 °C, this target still remains technically feasible, though extremely challenging. To keep open a realistic chance of meeting the 2 °C target, intensive action is required before 2020, the date by which a new international climate agreement is due to come into force. Energy is at the heart of this challenge: the energy sector accounts for around two-thirds of greenhouse-gas emissions, as more than 80% of global energy consumption is based on fossil fuels.

### *The energy sector is key to limiting climate change*

**Despite positive developments in some countries, global energy-related CO<sub>2</sub> emissions increased by 1.4% to reach 31.6 gigatonnes (Gt) in 2012, a historic high.** Non-OECD countries now account for 60% of global emissions, up from 45% in 2000. In 2012, China made the largest contribution to the increase in global CO<sub>2</sub> emissions, but its growth was one of the lowest it has seen in a decade, driven largely by the deployment of renewables and a significant improvement in the energy intensity of its economy. In the United States, a switch from coal to gas in power generation helped reduce emissions by 200 million tonnes (Mt), bringing them back to the level of the mid-1990s. However, the encouraging trends in China and the United States could well both be reversed. Despite an increase in coal use, emissions in Europe declined by 50 Mt as a result of economic contraction, growth in renewables and a cap on emissions from the industry and power sectors. Emissions in Japan increased by 70 Mt, as efforts to improve energy efficiency did not fully offset the use of fossil fuels to compensate for a reduction in nuclear power. Even after allowing for policies now being pursued, global energy-related greenhouse-gas emissions in 2020 are projected to be nearly 4 Gt CO<sub>2</sub>-equivalent (CO<sub>2</sub>-eq) higher than a level consistent with attaining the 2 °C target, highlighting the scale of the challenge still to be tackled just in this decade.

### *Four energy policies can keep the 2 °C target alive*

**We present our 4-for-2 °C Scenario, in which we propose the implementation of four policy measures that can help keep the door open to the 2 °C target through to 2020 at no net economic cost.** Relative to the level otherwise expected, these policies would reduce greenhouse-gas emissions by 3.1 Gt CO<sub>2</sub>-eq in 2020 – 80% of the emissions reduction

required under a 2 °C trajectory. This would buy precious time while international climate negotiations continue towards the important Conference of the Parties meeting in Paris in 2015 and the national policies necessary to implement an expected international agreement are put in place. The policies in the 4-for-2 °C Scenario have been selected because they meet key criteria: they can deliver significant reductions in energy-sector emissions by 2020 (as a bridge to further action); they rely only on existing technologies; they have already been adopted and proven in several countries; and, taken together, their widespread adoption would not harm economic growth in any country or region. The four policies are:

- Adopting specific energy efficiency measures (49% of the emissions savings).
- Limiting the construction and use of the least-efficient coal-fired power plants (21%).
- Minimising methane (CH<sub>4</sub>) emissions from upstream oil and gas production (18%).
- Accelerating the (partial) phase-out of subsidies to fossil-fuel consumption (12%).

**Targeted energy efficiency measures would reduce global energy-related emissions by 1.5 Gt in 2020, a level close to that of Russia today.** These policies include: energy performance standards in buildings for lighting, new appliances, and for new heating and cooling equipment; in industry for motor systems; and, in transport for road vehicles. Around 60% of the global savings in emissions are from the buildings sector. In countries where these efficiency policies already exist, such as the European Union, Japan, the United States and China, they need to be strengthened or extended. Other countries need to introduce such policies. All countries will need to take supporting actions to overcome the barriers to effective implementation. The additional global investment required would reach \$200 billion in 2020, but would be more than offset by reduced spending on fuel bills.

**Ensuring that new subcritical coal-fired plants are no longer built, and limiting the use of the least efficient existing ones, would reduce emissions by 640 Mt in 2020 and also help efforts to curb local air pollution.** Globally, the use of such plants would be one-quarter lower than would otherwise be expected in 2020. The share of power generation from renewables increases (from around 20% today to 27% in 2020), as does that from natural gas. Policies to reduce the role of inefficient coal power plants, such as emissions and air pollution standards and carbon prices, already exist in many countries. In our 4-for-2 °C Scenario, the largest emissions savings occur in China, the United States and India, all of which have a large coal-powered fleet.

**Methane releases into the atmosphere from the upstream oil and gas industry would be almost halved in 2020, compared with levels otherwise expected.** Around 1.1 Gt CO<sub>2</sub>-eq of methane, a potent greenhouse-gas, was released in 2010 by the upstream oil and gas industry. These releases, through venting and flaring, are equivalent to twice the total natural gas production of Nigeria. Reducing such releases into the atmosphere represents an effective complementary strategy to the reduction of CO<sub>2</sub> emissions. The necessary technologies are readily available, at relatively low cost, and policies are being adopted in some countries, such as the performance standards in the United States. The largest reductions achieved in the 4-for-2 °C Scenario are in Russia, the Middle East, the United States and Africa.

**Accelerated action towards a partial phase-out of fossil-fuel subsidies would reduce CO<sub>2</sub> emissions by 360 Mt in 2020 and enable energy efficiency policies.** Fossil-fuel subsidies amounted to \$523 billion in 2011, around six times the level of support to renewable energy. Currently, 15% of global CO<sub>2</sub> emissions receive an incentive of \$110 per tonne in the form of fossil-fuel subsidies while only 8% are subject to a carbon price. Growing budget pressures strengthen the case for fossil-fuel subsidy reform in many importing and exporting countries and political support has been building in recent years. G20 and Asia-Pacific Economic Cooperation (APEC) member countries have committed to phase out inefficient fossil-fuel subsidies and many are moving ahead with implementation.

### *Adaptation to the effects of climate change is necessary*

**The energy sector is not immune from the physical impacts of climate change and must adapt.** In mapping energy system vulnerabilities, we identify sudden and destructive impacts (caused by extreme weather events) that pose risks to power plants and grids, oil and gas installations, wind farms and other infrastructure. Other impacts are more gradual, such as changes to heating and cooling demand, sea level rise on coastal infrastructure, shifting weather patterns on hydropower and water scarcity on power plants. Disruptions to the energy system can also have significant knock-on effects on other critical services. To improve the climate resilience of the energy system, governments need to design and implement frameworks that encourage prudent adaptation, while the private sector should assess the risks and impacts as part of its investment decisions.

### *Anticipating climate policy can be a source of competitive advantage*

**The financial implications of stronger climate policies are not uniform across the energy industry and corporate strategy will need to adjust accordingly.** Under a 2 °C trajectory, net revenues for existing nuclear and renewables-based power plants would be boosted by \$1.8 trillion (in year-2011 dollars) through to 2035, while the revenues from existing coal-fired plants would decline by a similar level. Of new fossil-fuelled plants, 8% are retired before their investment is fully recovered. Almost 30% of new fossil-fuelled plants are fitted (or retro-fitted) with CCS, which acts as an asset protection strategy and enables more fossil fuel to be commercialised. A delay in CCS deployment would increase the cost of power sector decarbonisation by \$1 trillion and result in lost revenues for fossil fuel producers, particularly coal operators. Even under a 2 °C trajectory, no oil or gas field currently in production would need to shut down prematurely. Some fields yet to start production are not developed before 2035, meaning that around 5% to 6% of proven oil and gas reserves do not start to recover their exploration costs in this timeframe.

**Delaying stronger climate action to 2020 would come at a cost: \$1.5 trillion in low-carbon investments are avoided before 2020, but \$5 trillion in additional investments would be required thereafter to get back on track.** Delaying further action, even to the end of the current decade, would therefore result in substantial additional costs in the

energy sector and increase the risk that the use of energy assets is halted before the end of their economic life. The strong growth in energy demand expected in developing countries means that they stand to gain the most from investing early in low-carbon and more efficient infrastructure, as it reduces the risk of premature retirements or retrofits of carbon-intensive assets later on.

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IEA PUBLICATIONS, 9 rue de la Fédération, 75739 PARIS CEDEX 15  
Printed in France by International Energy Agency, June 2013  
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RELEASE: 12 NOVEMBER

# WORLD ENERGY OUTLOOK

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# REDRAWING THE ENERGY-CLIMATE MAP

## World Energy Outlook Special Report

Governments have decided collectively that the world needs to limit the average global temperature increase to no more than 2 °C and international negotiations are engaged to that end. Yet any resulting agreement will not emerge before 2015 and new legal obligations will not begin before 2020. Meanwhile, despite many countries taking new actions, the world is drifting further and further from the track it needs to follow.

The energy sector is the single largest source of climate-changing greenhouse-gas emissions and limiting these is an essential focus of action. The *World Energy Outlook* has published detailed analysis of the energy contribution to climate change for many years. But, amid major international economic preoccupations, there are worrying signs that the issue of climate change has slipped down the policy agenda. This Special Report seeks to bring it right back on top by showing that the dilemma can be tackled at no net economic cost.

The report:

- Maps out the current status and expectations of global climate and energy policy – what is happening and what (more) is needed?
- Sets out four specific measures for the energy sector that can be quickly and effectively implemented, at no net economic cost, to help keep the 2 °C target alive while international negotiations continue.
- Indicates elements of action to achieve further reductions, after 2020.
- Demonstrates that the energy sector, in its own interest, needs to address now the risks implicit in climate change – whether they be the physical impacts of climate change or the consequences of more drastic action later by governments as the need to curb emissions becomes imperative.

For more information, and the free download of this report, please visit:  
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