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# **Energy Sector Transformation: Issues and Options for the UNFCCC Negotiations**

Christina Hood (IEA) and Gregory Briner (OECD)

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## ABSTRACT

### Energy Sector Transformation: Issues and Options for the UNFCCC Negotiations

A key element in the success of limiting mean global surface temperature rise to below 2°C will be transformation of the energy sector globally. In addition to implementing already-available options for more efficient use of energy and low-emissions energy supply, action is needed now to put in place the conditions for longer-term structural change to low-emissions energy systems. This transformational change will involve linkages between actions, institutions, and processes, both inside and outside the UNFCCC framework. This paper explores how the 2015 climate agreement, along with the nationally-determined contributions that Parties make under it, could drive energy sector transformation in addition to tracking greenhouse gas outcomes.

**JEL Classification:** F53, O31, Q42, Q48, Q54

**Keywords:** mitigation, adaptation, climate finance, greenhouse gas, UNFCCC, climate change

## RÉSUMÉ

La transformation du secteur de l'énergie : enjeux et options à débattre lors des négociations de la CCNUCC

Un facteur essentiel pour parvenir à limiter l'augmentation de la température moyenne à la surface du globe à 2°C sera la transformation du secteur de l'énergie dans le monde entier. En plus de mettre en œuvre des solutions déjà disponibles permettant d'utiliser plus efficacement l'énergie et d'obtenir des approvisionnements énergétiques à faibles émissions, il faut agir dès aujourd'hui afin de créer les conditions propices à la mutation structurelle qui aboutira, à plus long terme, à la mise en place de systèmes énergétiques à faibles émissions. Les transformations nécessaires mettront en relation des actions, des institutions et des processus, à la fois dans le cadre de la CCNUCC et hors de ce cadre. Ce rapport analyse comment l'accord de 2015 sur le climat, ainsi que les contributions déterminées au niveau national que les Parties apporteront à ce titre, pourraient non seulement permettre de suivre les résultats obtenus concernant les gaz à effet de serre, mais aussi être les moteurs de la transformation du secteur de l'énergie.

**Classification JEL:** F53, O31, Q42, Q48, Q54

**Mots-clés:** Mots-clés: atténuation, adaptation, finance climat, gaz à effet de serre, CCNUCC, changement climatique

## FOREWORD

This document was prepared by the OECD and IEA Secretariats in 2014 in response to a request from the Climate Change Expert Group (CCXG) on the United Nations Framework Convention on Climate Change (UNFCCC). The CCXG oversees development of analytical papers for the purpose of providing useful and timely input to the climate change negotiations. These papers may also be useful to national policy-makers and other decision-makers. Authors work with the CCXG to develop these papers in a collaborative effort. However, the papers do not necessarily represent the views of the OECD or the IEA, nor are they intended to prejudge the views of countries participating in the CCXG. Rather, they are Secretariat information papers intended to inform Member countries, as well as the UNFCCC audience.

Members of the CCXG are Annex I and OECD countries. The Annex I Parties or countries referred to in this document are those listed in Annex I of the UNFCCC (as amended by the Conference of the Parties in 1997 and 2010): Australia, Austria, Belarus, Belgium, Bulgaria, Canada, Croatia, Czech Republic, Denmark, the European Community, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Monaco, the Netherlands, New Zealand, Norway, Poland, Portugal, Romania, the Russian Federation, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine, the United Kingdom of Great Britain and Northern Ireland, and the United States of America. As OECD member countries, Korea, Mexico, Chile, and Israel are also members of the CCXG. Where this document refers to “countries” or “governments”, it is also intended to include “regional economic organisations”, if appropriate.

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### **Questions and comments should be sent to:**

Christina Hood  
International Energy Agency  
9 rue de la Fédération  
75739 Paris Cedex 15  
France  
Email: [Christina.hood@iea.org](mailto:Christina.hood@iea.org)

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## 1. Introduction

The energy sector currently produces around two thirds of global greenhouse gas (GHG) emissions and over 80% of carbon dioxide (CO<sub>2</sub>) (IEA, 2014a). Demand for energy services will continue to grow to fuel economic growth and social development, so deep cuts in emissions globally will not be possible without transforming the way energy is supplied and consumed. Immediate action is needed on two fronts: to implement options that are available today for more efficient energy use and low-emissions supply, and to put in place the conditions for longer-term structural changes to more efficient and low-emissions energy systems. For both, strong domestic energy and climate policies are critical to drive the necessary change, along with an enabling environment including institutional capacity, supportive energy market structures and infrastructure, and availability of finance. Energy modelling suggests that the difficulty of the challenge would be significantly increased if additional mitigation effort is considerably delayed or if there is only limited availability of key technologies such as bioenergy and carbon capture and storage (CCS) (IPCC, 2014).

Recent experience demonstrates that capital is available for low-emissions energy investments if domestic market and policy conditions are favourable (IEA, 2014b). For example, investment in European power plants increased five-fold between 2000 and 2011, driven primarily by support policies for renewable energy technologies. Wind and solar PV accounted for 60% of all European generation investment over this period (IEA, 2014b). Yet much potential for change remains untapped. For example, the IEA has found that to 2020, 80% of the gap between baseline emissions and an economically-optimal 2 °C scenario can be met with a set of four key actions<sup>1</sup> that have zero net GDP impact (IEA, 2013).

A new climate agreement is being negotiated under the UNFCCC, to apply from 2020. This paper will explore three particular elements of how this new climate agreement, along with the “nationally-determined contributions” that Parties take under it, could encourage transformative energy sector policies and actions:

- Sending long-term policy signals to underpin long-lived investments in energy systems.
- Mobilising non-climate and sub-national objectives to enhance emissions reduction outcomes.
- Accelerating development of key clean energy technologies.

There are a number of other issues of specific relevance to energy sector transformation that are not covered in detail in this paper. Carbon pricing is a key tool to shift energy sector investment and operational decisions, and the 2015 agreement could put in place a framework to facilitate the use of high-quality carbon markets for those countries choosing to participate. Options for the treatment of tradable GHG units under the UNFCCC are covered in Prag, Briner and Hood (2012), Prag, Hood and Barata (2013), and Hood, Briner and Rocha (2014). Finance is another critical element, both in terms of scaling up total investment and redirecting energy investment into cleaner options. Improved mobilisation of finance for climate mitigation is discussed in detail in e.g. Kato and Ellis (2014), Corfee-Morlot et al. (2012) and not duplicated here.

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<sup>1</sup> The four actions are energy efficiency, reduced use of inefficient coal, fossil fuel subsidy reform, and reduced methane venting and flaring.

## 2. Sending long-term policy signals to underpin long-lived investments in energy systems

Infrastructure used in energy supply (e.g. power plants, pipelines) and energy consumption (e.g. buildings, industrial plants) can be long-lived. For example, in the IEA's Energy Technology Perspectives model, coal-fired power plants have a nominal lifetime of 40 years. In fact, lifetimes can be extended far beyond this – the average age of coal plant in the United States is 42 years, and some plants built in the 1940s and 1950s are still operating today. If the infrastructure being built today operates over similar time scales, it will still be in service at a time when the entire energy system needs to reach near zero or below GHG emissions (IPCC, 2014).

Short- to medium-term greenhouse gas emissions goals (such as Kyoto Protocol targets) can be met in multiple ways. If countries' focus is only on short-term emissions targets then the tendency is to focus on "low hanging fruit", i.e. meeting the goal with least-cost actions. However, a focus only on short-term actions could lead to continued investment in fossil fuel infrastructure, thus "locking in" emissions for decades to come and undermining the prospect of future deep emissions reductions.<sup>2</sup> The greatest risk for future lock-in is in countries where key infrastructure (e.g. buildings, power stations, transport networks) is yet to be built. A challenge for the 2015 agreement is therefore to maximise short-term action while shifting investment in long-lived infrastructure onto a path consistent with the below 2 °C goal.

Businesses need a clear signal that a global low-carbon economy "is not only inevitable, it is coming rapidly" (Morgan, 2014). Options for possible provisions that could be included in the 2015 agreement to bring in a greater long-term focus, complementing shorter-term targets, include:

- Setting a long-term global GHG emissions goal (e.g. an emissions level in 2050, or date for net-zero global emissions). This would provide a clear signal of policy direction, but would need to be translated into long-term commitments in countries' domestic laws in order to significantly shift infrastructure investment.
- As part of their nationally-determined contributions, Parties could be encouraged to put forward both short- and long-term national mitigation goals (Haites et al., 2013). Parties would need to demonstrate that each short-term goal is consistent with a pathway toward the long-term goal. This could help encourage more ambitious short-term mitigation goals, but these short-term goals might still be met while leaving underlying infrastructure investment off-course.
- Tracking and reporting processes for mitigation contributions could apply both to short- and long-term goals. The short-term goal could be tracked in terms of GHG emissions (or other relevant metric), while progress toward the long-term goal could be reported using a nationally determined basket of indicators that capture the underlying drivers of change (e.g. rate of investment in clean power generation, implementation of carbon pricing, research, development and deployment investment). A greater level of information on the underlying drivers of change, and progress being made in shifting them, could give greater credibility to mitigation goals and therefore underpin greater investor confidence (Spencer et al., 2014).
- Complementing short- and long-term GHG goals, countries could choose to put forward nationally-determined contributions framed in terms of key drivers of energy sector decarbonisation. For example, a country could make a commitment in terms of the percentage of

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2 For this reason, the New Climate Economy project concluded that energy investment in the next 15 years or so will be crucial in determining whether the below 2 °C goal is met (New Climate Economy, 2014).

new investment in power generation that will be low or zero carbon over a given time frame. This approach would move the focus onto encouraging short-term actions that are consistent with long-term targets, rather than relying only on the “pull” of the emissions target alone to drive change.

Within the 2015 agreement, a regular review cycle for mitigation contributions, coupled with a clear long-term direction of travel for emissions reductions, could build confidence that governments’ resolve will strengthen rather than dissipate over time as the agreement is implemented. As technology costs fall and governments gain experience in policy delivery, reviews of mitigation contributions could help Parties identify areas in which their mitigation ambition could be scaled up.

Whatever the agreed text of the 2015 agreement, investor confidence and behaviour in the energy sector will depend on the signals they are receiving through domestic policies. Businesses considering investment in low-carbon assets will look for credible and ambitious domestic climate and energy policies, but will also make their own judgements on the likelihood of governments’ long-term commitment to these policies in the face of other economic and social priorities. Governments’ own actions in showing resolve, providing policy stability and demonstrating commitment through purchasing decisions are therefore also key elements in supporting energy sector transformation.

### **3. Mobilising non-climate and sub-national objectives to enhance emissions reduction outcomes**

Stepping up short-term emissions reductions is critical if global emissions are to be low enough in 2020 (and 2030) to keep a below 2°C pathway within reach. In the energy sector, some key emissions-reducing activities may be motivated primarily by other benefits. For example, energy efficiency has benefits relating to the economy, health outcomes, energy suppliers and purchasers, and industrial productivity (IEA, 2014c), and air quality concerns can be a strong driver of policies for electricity generation (IEA, 2014d). Therefore, while energy sector actions are among the largest “wedges” of mitigation potential, the best motivation for action in the short term may sometimes be non-climate policy objectives (Prag, Kimmel and Hood, 2013).

To motivate maximum action in the short term in the context of UNFCCC arrangements, it could be beneficial to find a role for non-GHG energy sector metrics (such as information on energy efficiency or renewable energy penetration) to support short-term GHG goals. For example, information on energy sector metrics could be reported to underpin and explain progress made or expected towards GHG goals, creating greater trust and understanding (Spencer et al, 2014), or nationally-determined contributions by some small emitters could be framed in non-GHG metrics (Hood, Briner and Rocha, 2014). Within the UNFCCC framework, Parties could also consider whether development of common frameworks for mitigation action in the energy sector is useful (analogous to the framework for Reducing Emissions from Deforestation and Forest Degradation which creates a model for enhanced action for those Parties wishing to participate).

Because a number of energy sector actions that reduce GHG emissions are motivated at least in part by non-GHG benefits, institutional structures outside the UNFCCC that focus on non-GHG drivers could play an important role in accelerating mitigation action. The UNFCCC database of international co-operative initiatives (UNFCCC, 2014) currently shows over 30 initiatives in the energy sector. The UNFCCC process could recognise and encourage such initiatives, although it remains unclear whether bringing them (including those at regional, city, or company level) into the 2015 agreement itself is the best way to catalyse action.



Tracking progress at the global level in energy sector transformation<sup>3</sup> could prompt greater action by countries. For example, if global improvements in energy efficiency are lower than the economic potentials suggest (and hence countries are forgoing cost-effective means of meeting their GHG goals), international tracking and reporting of this gap could encourage countries to do more. For example, it could prompt them to join energy efficiency initiatives and partnerships that would help them overcome market barriers and adopt best-practise policies. Reporting of trends in energy sector transformation could be compiled either within the UNFCCC, or by outside agencies such as the IEA.

Energy sector emissions reductions could also be stimulated in the short-term by highlighting synergies between mitigation and adaptation outcomes. Adapting to current and future climate impacts is necessary to underpin secure energy supplies (WBCSD, 2014). At the same time, the nature of climate impacts will affect the actions that are feasible and economic for mitigation in the energy sector. For example, decreased river flows and higher water temperatures can make cooling thermal electricity generating plant more difficult and hence more costly, which provides an economic incentive to shift toward generating technologies that require less (or no) cooling. Further, some mitigation actions such as residential insulation can have adaptation co-benefits such as providing greater resilience to temperature extremes. In regions under increasing water and heat stress, it will be a significant challenge to simultaneously balance food production and biomass availability for energy. These types of inter-linkages should be considered as countries consider the nationally-determined contributions they intend to put forward as part of the 2015 agreement. The agreement could encourage integrated planning, for example by asking countries to report how short-term mitigation and adaptation targets and actions are consistent with long-term mitigation and adaptation goals.

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3 For example tracking metrics such as the emissions intensity of energy supply, and energy intensity of GDP.

## 4. Accelerating development of key clean energy technologies

The UNFCCC has already taken considerable steps to address technology issues (Table 1). The Technology Mechanism of the UNFCCC delivers a number of functions, including facilitating assessments of countries' technology needs and providing access to technical assistance and technology transfer through the Climate Technology Centre and Network.

**Table 1: Existing UNFCCC institutions and arrangements for technology**

Institution/ arrangement (year established)	Aim	Links with other institutions and arrangements
Poznan Strategic Program on Technology Transfer (2008)	To help developing countries adopt environmentally sound technologies, e.g. through support for Technology Needs Assessments and pilot projects	<ul style="list-style-type: none"> <li>• Programme developed by the GEF</li> <li>• Pilot projects have been implemented with the support from UNDP, UNIDO, IFAD, IDB, World Bank, AfDB</li> </ul>
Technology Executive Committee (2010)	Provides strategic guidance on technology development and transfer (e.g. deployment, needs assessments, endogenous capacities)	<ul style="list-style-type: none"> <li>• The TEC and the CTCN are linked under the Technology Mechanism</li> <li>• Members of other bodies (e.g. Standing Committee on Finance, Adaptation Committee) are invited to TEC meetings</li> </ul>
Climate Technology Centre and Network (2010)	To provide technical assistance for developing countries; share information; foster collaboration and networking	<ul style="list-style-type: none"> <li>• Requested to elaborate linkages with non-UNFCCC institutions (e.g. WIPO invited to TEC meeting)</li> <li>• Works with UNEP, GEF and other private and public institutions</li> </ul>

Source: Briner et al. (2014)

One critical issue for energy sector transformation that is not yet being adequately addressed is research, development and deployment (RD&D) for low-emission technologies. The IEA's Tracking Clean Energy Progress report measures deployment of (and RD&D investment in) key technologies that will be needed in coming decades for a below 2°C scenario. The 2014 report finds that RD&D in all energy technologies except mature renewable electricity generation is below the rate needed for consistency with a below 2°C scenario (IEA, 2014e). Similarly, the Deep Decarbonisation Pathways project highlighted the need for a major technology R&D push to ensure critical technologies are commercialised and affordable (SDSN and IDDRI, 2014).

A committed global effort on technology RD&D is not only linked to prospects for success of long-term mitigation, but will also underpin short-term political willingness to enter into long-term targets. If countries can be given greater confidence that key technologies are likely to be available and affordable in future, they may be more confident in taking on ambitious mitigation goals in the UNFCCC. As with many energy-sector actions, energy RD&D is primarily driven by policy priorities and institutions outside the UNFCCC process. There remains an open question as to whether Parties will see encouraging action on RD&D as within the scope of the 2015 climate agreement. Whether or not this is the case, better information (whether compiled within the UNFCCC or by outside agencies) on RD&D trends would be useful to underpin mitigation contributions. Options for further action include:

- Making better use of the national communications process under the UNFCCC to highlight national actions on technology RD&D.
- Inviting the Technology Executive Committee (TEC), or an agency outside the UNFCCC, to track global RD&D progress for a set of key technologies. Where progress is short of that

consistent with the below 2°C goal, a work programme could be established whereby Parties report in greater detail what (if any) further actions they intend to take to address the gap.

- Tracking and reporting national RD&D activities could form part of a broad set of nationally determined indicators used to demonstrate progress toward long-term emissions goals.

There are already a very large number of actors, organisations and partnerships involved in collaborative RD&D. Rather than launching new initiatives, there might be value in considering information on the adequacy of RD&D trends in a more formal way under the UNFCCC.

## **5. Conclusions**

The issue of long-term emissions goals in the 2015 agreement is under discussion. An important issue for the energy sector will be not only whether there will be a long-term global emissions goal (in addition to nationally determined contributions), but also how any long-term emissions goals will be made meaningful in the short term and provide a strong enough signal to drive cleaner infrastructure investment. Being required to report on progress towards long-term emissions goals could encourage countries to implement policies domestically to shift towards low-emissions infrastructure investment.

Transformative change in the energy sector is needed, and requires actions focused on both short- and long-term emissions reductions. Given that energy sector actions to reduce emissions can be motivated by other benefits, it could be helpful to find a role for energy sector metrics (such as energy efficiency, renewable energy penetration or carbon capture and storage deployment) to support and complement GHG goals. There could also be value in the UNFCCC or an outside agency compiling information on key energy trends (e.g. energy efficiency progress), to highlight opportunities for greater emissions reductions. Similarly, greater transparency on global RD&D progress in key technologies would provide useful information to Parties developing mitigation contributions, and could also encourage greater action in RD&D activities.

These issues of balancing short- and long-term objectives while managing differing climate and non-climate policy objectives may also be applicable to other sectors. The process for developing nationally-determined contributions for the 2015 agreement could also benefit from a linking of short- and long-term objectives in other sectors (for example, agriculture, forestry and other land use). As countries develop their nationally-determined mitigation contributions, linkages across timeframes as well as synergies with adaptation outcomes should be considered.

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