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July 21, 2014

Hubert T. Bell, Inspector General
U.S. Nuclear Regulatory Commission
Washington, DC 20555
Hubert.Bell@nrc.gov

SUBJECT: *Request for Investigation into Conflict of Interest by Commissioner William D. Magwood IV*

Dear Mr. Bell:

On behalf of 34 environmental organizations and individuals,[1] we are writing to ask you, as the NRC's Inspector General, to open an investigation into an actual and apparent conflict of interest by U.S. Nuclear Regulatory Commission ("NRC") member William D. Magwood IV. Our request follows up on a letter we wrote to Mr. Magwood on June 18, 2014, demanding his immediate resignation due to the real and apparent conflict of interest created by his pursuit of and acceptance of the position of Director-General with the Organisation for Economic Co-Operation and Development's ("OECD's") Nuclear Energy Agency ("NEA").[2] We also demanded that Mr. Magwood recuse himself from all NRC decisions relating to safety that date back to his application for a position with the NEA, and that he release records related to his application for a position with the NEA.

As explained in our June 18 letter, Mr. Magwood's conflict of interest arises from the fact that NEA is an organization (a) that actively promotes "the development of the production and uses of nuclear energy," and (b) whose policies are set by member governments, including a number that own or sponsor U.S. nuclear licensees and applicants.[3] In appearance and in actuality, Mr. Magwood is now committed to an organization whose mandate to promote nuclear energy as well as the economic interests of its members is antithetical to the basic principles of the Energy

[1] Alliance to Halt Fermi 3, Beyond Nuclear, Blue Ridge Environmental Defense League, Center for a Sustainable Coast, Citizens Allied for Safe Energy, Citizens Environmental Coalition, Citizens Resistance at Fermi 2, Coalition for a Nuclear Free Great Lakes, Don't Waste Michigan, Kay Drey, Ecology Party of Florida, Friends of the Coast, Friends of the Earth, Green States Solutions, Hudson River Sloop Clearwater, Indian Point Safe Energy Coalition, Captain Dan Kipnis, Missouri Coalition for the Environment, NC WARN, Nevada Nuclear Waste Task Force, New England Coalition, Northwest Environmental Advocates, Nuclear Energy Information Service, Nuclear Information and Resource Service, Nuclear Watch South, Physicians for Social Responsibility, Public Health and Sustainable Energy, Riverkeeper, San Clemente Green, San Luis Obispo Mothers for Peace, San Onofre Safety, SEED Coalition, Sierra Club Nuclear Free Campaign, and Southern Alliance for Clean Energy. These organizations are active participants in NRC rulemakings, licensing proceedings, and other regulatory proceedings in which Commissioner Magwood has played or may play a decision-making role.

[2] Letter from Diane Curran and Mindy Goldstein to William D. Magwood IV ("June 18 Letter"). A copy of our June 18 letter was also sent to you. A copy is included here as Attachment A.

[3] Statute of the OECD Nuclear Energy Agency, Articles 1 and 8 (as amended on 13 July 1995), https://www.oecd-nea.org/nea/statute.html.

Reorganization Act of 1974 that safety, not economics, must be the NRC's paramount consideration and that promotional policies shall be left to the U.S. Department of Energy ("DOE").[4] As we pointed out, such a blending of economic promotion with safety regulation was a root cause of the regulatory failures that paved the way for the Fukushima disaster in Japan. Mr. Magwood's continued participation in NRC safety decisions, after soliciting and accepting employment with the NEA, also violates 28 U.S.C. §455 by creating an unacceptable appearance of bias.

On July 14, 2014, Mr. Magwood responded to our June 18 letter by refusing to take any of the actions we requested.[5] He also refused a similar request to recuse himself from an NRC licensing proceeding for the proposed Fermi Nuclear Power Plant, Unit 3.[6]

Mr. Magwood asserts in his July 14 letter that a reasonable person would not question his impartiality because:

> NEA does not advocate any particular outcome but, with the support of its member countries, focuses on facilitating policy analyses, sharing information and experience amongst its members, developing cooperative research projects and developing consensus positions on technical issues, including those relevant to nuclear safety regulators around the world.[7]

Mr. Magwood's statement that NEA "does not advocate any particular outcome" is incorrect. Under the NEA's charter, the use of nuclear power is a *given,* not an option. The clearly stated purpose of the NEA is to "*further* the development of the production and uses of nuclear energy . . . for peaceful purposes by the participating countries, through co-operation between those countries and a harmonization of measures taken at the national level."[8] Thus, NEA's primary

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[4] *See* http://www.nrc.gov/about-nrc/governing-laws.html.

[5] Letter from William D. Magwood IV to Mindy Goldstein; Letter from William D. Magwood IV to Diane Curran. The letters are identical. A copy of Mr. Magwood's letter to Diane Curran ("Magwood Letter") is included here as Attachment B.

[6] Decision on the Motion of Beyond Nuclear for Recusal From Participation in Deliberations on Petition for Review of LBP-14-07 (July 14, 2014) ("Fermi Recusal Decision"). A copy of that decision is included here as Attachment C.

[7] Magwood Letter at 2. Similarly, in his Fermi Recusal Decision, Mr. Magwood states that NEA:

> focuses not on the 'development and maintenance of . . . nuclear power,' as intervenors appear to contend, but upon the development and maintenance of the scientific, technical, and legal basis for ensuring that nuclear power, where it is used, is used in a safe, environmentally friendly, and economical manner.

Fermi Recusal Decision at 5 (citing Strategic Plan of the NEA).

[8] Statute of the OECD Nuclear Energy Agency, Part I, Article 1 (emphasis added).

focus is on the development of nuclear energy.[9] By setting a goal of promoting nuclear energy, the NEA presupposes that it can be made safe. The NRC, on the other hand, can make no such presumption. Under the Atomic Energy Act, if operation of a nuclear facility would be "inimical" to public health and safety, the NRC may not license it at all.[10]

The NEA's fundamentally promotional approach to nuclear energy is also reflected in the NEA's publications. For instance, the NEA identifies nuclear energy as a necessary "element" of the "energy revolution" that is needed to address climate change.[11] And in order to ensure that nuclear energy is part of the energy revolution, the NEA openly promotes government and market support for it:

> Many clean and non-import dependent technologies, including some renewable technologies, carbon capture and storage and *nuclear power, need government support* that reflects the added benefits for the environment and from reduced import dependence.[12]

The fact that NEA is also engaged in safety research, as Mr. Magwood contends, does not negate the conflict created by its simultaneous promotional efforts. Rather, it shows that NEA mixes safety and economics in much the same way that drove Congress to split the Atomic Energy Commission into two agencies in the Energy Reorganization Act of 1974. While NEA is free to embrace these two conflicting approaches in a single agency, Mr. Magwood, as an NRC

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[9] This promotional purpose is also consistent with the three founding purposes of the OECD, which are all related to encouraging economic development:

> (a) To "achieve the highest sustainable economic growth and employment and a rising standard of living in Member countries, while maintaining financial stability, and thus to contribute to the development of the world economy;
>
> (b) To contribute to sound economic expansion in Member as well as non-member countries in the process of economic development; and
>
> (c) To contribute to the expansion of world trade on a multilateral, non-discriminatory basis in accordance with international obligations.

Convention on the OECD (1960), http://www.oecd.org/general/conventionontheorganisationforeconomicco-operationanddevelopment.htm.

[10] *See, e.g.,* 42 U.S.C. § 2133(d).

[11] According to an NEA preliminary "Green Growth" study on energy:

> The energy revolution that is needed can be characterized by the following elements: improved energy efficiency, widespread introduction of carbon capture and storage, increased deployment of renewable energy, nuclear energy, continued fuel switching, and support for new and enabling technologies.

OECD Preliminary Green Growth Studies (Energy) at 23 (2011) (Attachment D).

[12] *Id.* at 46 (emphasis added).

Commissioner, may not. His letter is alarming for its utter failure to recognize the existence of that conflict.

Mr. Magwood also claims he has no conflict of interest because NEA has no financial, research or policy interests that would be directly affected by his decisions.[13] But he completely fails to address the fact that the NEA members who have hired him include countries that own or sponsor U.S. nuclear licensees or applicants, such as France (MOX Fuel Fabrication Facility through AREVA; Nine Mile Point Units 1 and 2, Calvert Cliffs Units 1 and 2, and Ginna through Electricité de France) and the Netherlands (Louisiana Enrichment Services through URENCO).[14] He also overlooks the fact that NEA promotes the financial interests of many private nuclear companies doing business in the U.S. and other countries.

Therefore, we request you to open an independent investigation into the question of whether and to what extent Mr. Magwood has violated federal ethics rules and/or statutory prohibitions against real or apparent conflicts of interest. Should you conclude that Mr. Magwood has indeed violated federal ethics standards, we ask you to refer this matter to the U.S. Department of Justice.

In addition, we ask you to investigate how such a blatant conflict of interest could have occurred, given the existence of NRC procedures for vetting potential conflicts of interest.[15] In making this inquiry, we urge you to determine whether NRC officials assisted Mr. Magwood in making his application and if so, whether they provided him with appropriate counsel regarding his ethical obligations to step down or recuse himself from NRC safety decisions after applying.

Thank you for your consideration.

Sincerely,

[Electronically signed by]
Diane Curran

[Electronically signed by]
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[13] Magwood Letter at 2.

[14] June 18 Letter at 1 note 2.

[15] *See, e.g.,* Summary of Major Ethics Rules for NRC Employees (August 20, 2009) (ML092380142); NRC Management Directive 7.9, Ethical Approvals and Waivers (Sept. 29, 2009) (ML091030381).

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Joint Counsel to Environmental Organizations

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Sen. Barbara Boxer, Chairman
Committee on Environment and Public Works

Sen. Sheldon Whitehouse, Chairman
Subcommittee on Clean Air and Nuclear Energy

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ATTACHMENT A

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June 18, 2014

William D. Magwood, IV
U.S. Nuclear Regulatory Commission
Washington, DC 20555
By e-mail to: William.Magwood@nrc.gov

SUBJECT: *Demand for Immediate Resignation from the NRC and Other Measures*

Dear Mr. Magwood:

On behalf of 34 environmental organizations and individuals,[1] we are writing to demand your immediate resignation from the U.S. Nuclear Regulatory Commission ("NRC"). You have fatally compromised your role as an independent safety regulator by negotiating for and accepting the position of Director-General with the Organisation for Economic Co-Operation and Development's ("OECD's") Nuclear Energy Agency ("NEA"), an organization (a) that actively promotes "the development of the production and uses of nuclear energy;" and (b) whose policies are set by member governments, including a number that own or sponsor U.S. nuclear licensees and applicants.[2] In appearance and in actuality, you are now committed to an organization whose mandate to promote nuclear energy as well as the economic interests of its members is antithetical to the basic principles of the Energy Reorganization Act of 1974 that safety, not economics, must be the NRC's paramount consideration and that promotional policies shall be left to the U.S. Department of Energy ("DOE").[3] It is precisely the blending of

[1] Alliance to Halt Fermi 3, Beyond Nuclear, Blue Ridge Environmental Defense League, Center for a Sustainable Coast, Citizens Allied for Safe Energy, Citizens Environmental Coalition, Citizens Resistance at Fermi 2, Coalition for a Nuclear Free Great Lakes, Don't Waste Michigan, Kay Drey, Ecology Party of Florida, Friends of the Coast, Friends of the Earth, Green States Solutions, Hudson River Sloop Clearwater, Indian Point Safe Energy Coalition, Captain Dan Kipnis, Missouri Coalition for the Environment, NC WARN, Nevada Nuclear Waste Task Force, New England Coalition, Northwest Environmental Advocates, Nuclear Energy Information Service, Nuclear Information and Resource Service, Nuclear Watch South, Physicians for Social Responsibility, Public Health and Sustainable Energy, Riverkeeper, San Clemente Green, San Luis Obispo Mothers for Peace, San Onofre Safety, SEED Coalition, Sierra Club Nuclear Free Campaign, and Southern Alliance for Clean Energy. These organizations are active participants in NRC rulemakings, licensing proceedings, and other regulatory proceedings in which you have played or may play a decision-making role.

[2] Statute of the OECD Nuclear Energy Agency, Articles 1 and 8 (as amended on 13 July 1995), https://www.oecd-nea.org/nea/statute.html. Countries that own or sponsor U.S. nuclear licensees or applicants include, for example, France (MOX Fuel Fabrication Facility through AREVA; Nine Mile Point Units 1 and 2, Calvert Cliffs Units 1 and 2, and Ginna through Electricité de France) and the Netherlands (Louisiana Enrichment Services through URENCO). NEA also promotes the financial interests of many private nuclear companies doing business in the U.S. and other countries.

[3] As summarized on the NRC's website:

economic promotion with safety regulation that was a root cause of the regulatory failures that paved the way for the Fukushima disaster in Japan.[4]

Your continued presence on the Commission also violates federal law governing the impartiality of judges. Under 28 U.S.C. § 455, you must recuse yourself from any NRC decision in which your "impartiality might reasonably be questioned."[5] As noted above, NEA seeks to "further the development of the production and uses of nuclear energy."[6] Having accepted the position of NEA Director-General, you now appear biased towards the protection of the NEA's interests. The fact that NEA and others are already identifying you as an NEA employee only aggravates your appearance of bias.[7] Thus, in any NRC proceeding involving proposed safety determinations that are inconsistent with the pronuclear economic mandate of NEA and its members, a reasonable person would question your independence and objectivity in applying NRC safety requirements or judging the significance of safety issues – especially when you are forced to consider a solution to a safety issue that could significantly increase the cost of nuclear power production and thus limit its viability in the marketplace.

> Under the Atomic Energy Act of 1954, a single agency, the Atomic Energy Commission, had responsibility for the development and production of nuclear weapons and for both the development and the safety regulation of the civilian uses of nuclear materials. The Act of 1974 split these functions, assigning to one agency, now the Department of Energy, the responsibility for the development and production of nuclear weapons, promotion of nuclear power, and other energy-related work, and assigning to the NRC the regulatory work, which does not include regulation of defense nuclear facilities.

http://www.nrc.gov/about-nrc/governing-laws.html.

[4] For example, the National Diet of Japan's investigation into the causes of the Fukushima accident concluded that "[t]he regulatory authorities' supposed independence from the ministries promoting nuclear energy and the nuclear operators was a mere façade." Introduction to Main Report of the Nuclear Accident Independent Investigation Commission of the Japanese Diet at 16 (July 5, 2012). http://warp.da.ndl.go.jp/info:ndljp/pid/3856371/naiic.go.jp/en/report/.

[5] *See also Houston Lighting and Power Co.* (Allens Creek Nuclear Generating Station, Unit 1), CLI-82-9, 15 NRC 1363, 1365-67 (1982).

[6] *See* note 3.

[7] For instance, the OECD's 2014 Annual Report posts your photograph with the caption: "William Magwood, Director General" of the NEA. OECD 2014 Annual Report to Ministers at 110, Attachment 1 (excerpt). Only in the small print of a footnote does the Annual Report state that you will not "take up your duties" until September 2014. *Id.* Similarly, in a report of a recent "Summer Institute" sponsored by the World Nuclear University ("WNU") for the "next generation of nuclear leaders," the WNU describes you as "US NRC Commissioner and appointed OECD/NEA DG." World Nuclear Association Blog (April 2014), http://www.world-nuclear.org/Source/Pages/WNA/Blog.aspx?blogmonth=4&blogday=14&blogyear=2014&blogid=3701&id=36478&LangType=2057. The purposes of the World Nuclear University include "strengthening the development of a new generation of leaders for the nuclear industry." http://www.world-nuclear-university.org/summerinstitute/whythewnu.aspx.

Your apparent lack of impartiality dates back at least nine months, to the time when you applied for the position of Director-General at the NEA.[8] While your application was pending with the NEA, you had a strong incentive to improve your employment prospects by avoiding safety decisions that would exacerbate nuclear power's ongoing economic difficulties. During that period, you voted against further research by the NRC Staff on two important post-Fukushima issues: the adequacy of the scope of NRC's safety regulations and whether the NRC should order the expedited transfer of spent fuel from high-density storage pools into dry storage.[9] Given that further research on both issues could have led to the imposition of additional costly safety requirements on reactor licensees, in conflict with the NEA's interests in minimizing reactor costs, a reasonable person would question the objectivity of your vote against further inquiry by the Staff.

As you should be aware, the NRC's Office of Inspector General ("OIG") found that former Commissioner Merrifield violated federal ethics rules by soliciting employment with the nuclear industry while serving as an NRC Commissioner, without recusing himself from decisions in which his prospective employer had a financial interest.[10] Like Commissioner Merrifield, you have failed to take measures to ensure that your employment negotiations and acceptance of a position with an organization that promotes the nuclear industry would not create a conflict of interest with your responsibilities as an NRC Commissioner.

Therefore, in order to avoid the reality and the appearance of bias in future decisions, you should resign from your position as NRC Commissioner. In addition, you should disqualify yourself *retroactively* from all safety decisions you made after applying to the NEA for your position.

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[8] A job notice posted on LinkedIn (http://fr.linkedin.com/jobs2/view/6466687) states that the deadline for applications for the position closed on September 3, 2013.

[9] *See* Commission Voting Record, Decision Item: SECY-13-0132, U.S. Nuclear Regulatory Commission Staff Recommendation for the Disposition of Recommendation 1 of the Near-Term Task Force Report (May 19, 2014); Commissioner Vote Sheets on COMSECY-13-0030, Staff Evaluation and Recommendation for Japan Lessons-Learned Tier 3 Issue on Expedited Transfer of Spent Fuel (May 27, 2014). These documents can be found on the NRC's website at http://www.nrc.gov/reading-rm/doc-collections/commission/recent/2014/.

[10] Memorandum from Hubert T. Bell, Inspector General, to NRC Chairman Jaczko re: Alleged Conflict of Interest by Former NRC Commissioner (Case No. 07-63) (Sept. 17, 2009), Attachment 2. The OIG concluded that Mr. Merrifield "did not take effective measures to prevent a potential conflict of interest during the last 2 months of his term," because he negotiated for future employment without ensuring that he "disqualified himself from involvement with potential conflict of interest issues." *Id.* at 11. In contrast, in a subsequent investigation of former NRC Chairman Dale Klein, the OIG concluded that Mr. Klein avoided creating a conflict of interest during his term on the NRC by "decid[ing] simply not to address any prospective employment offers while at NRC." Memorandum from [name withheld], Office of Inspector General, to Joseph A. McMillan, Assistant Inspector General for Investigations re: Potential Conflict-of-Interest Violation of Ethics Requirements by Former Commissioner Klein (OIG Case No. 10-39) at 3 (Sept. 28, 2010), Attachment 3.

Finally, we demand that you publicly release your application to the NEA and all related correspondence, including endorsements and recommendations by U.S. officials. Full disclosure of these documents is necessary to clarify your statement that you were "the U.S. Government's candidate" for the Director-General position at NEA.[11] If there was, indeed, a formal process for your nomination to the NEA by U.S. government officials, the information should be made public as a matter of course under the Freedom of Information Act.

However, we can find no evidence of a formal nomination process for the position of NEA's Director-General. Instead, a job notice posted on LinkedIn directs applicants to submit a curriculum vita, "motivation letter," three references, and answers to "a few short questions."[12] Thus, it appears that senior government U.S. officials wrote recommendation letters to the NEA on your behalf as a personal courtesy.

If senior government officials have used their offices to recommend you for a job so at odds with your responsibilities as an NRC Commissioner, the public deserves to know the basis for their recommendations. The public also deserves to know whether the senior government officials who endorsed your employment by the NEA included officials of the NRC and/or the DOE. If so, they should be called to account for subverting the purposes of the Energy Reorganization Act of 1974 by helping you to obtain a position with the NEA, without insisting on your recusal from safety decisions during the pendency of your application and your resignation from the NRC after your hire.

Sincerely,

[Electronically signed by]
Diane Curran

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Joint Counsel to Environmental Organizations

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[11] Statement of Commissioner William D. Magwood, IV, United States Nuclear Regulatory Commission, to the House Committee on Energy and Commerce Subcommittee on Energy and Power (May 7, 2014), Attachment 4. You have also been quoted in the press as giving thanks for the "strong support and encouragement" that you received "from senior officials of the Administration to take on [the NEA] assignment." "NRC Commissioner Magwood Set to Leave Commission for International Agency," Radwaste Monitor, Vol. 7 No. 11 (Mar. 21, 2014), Attachment 5 (excerpt).

[12] http://fr.linkedin.com/jobs2/view/6466687.

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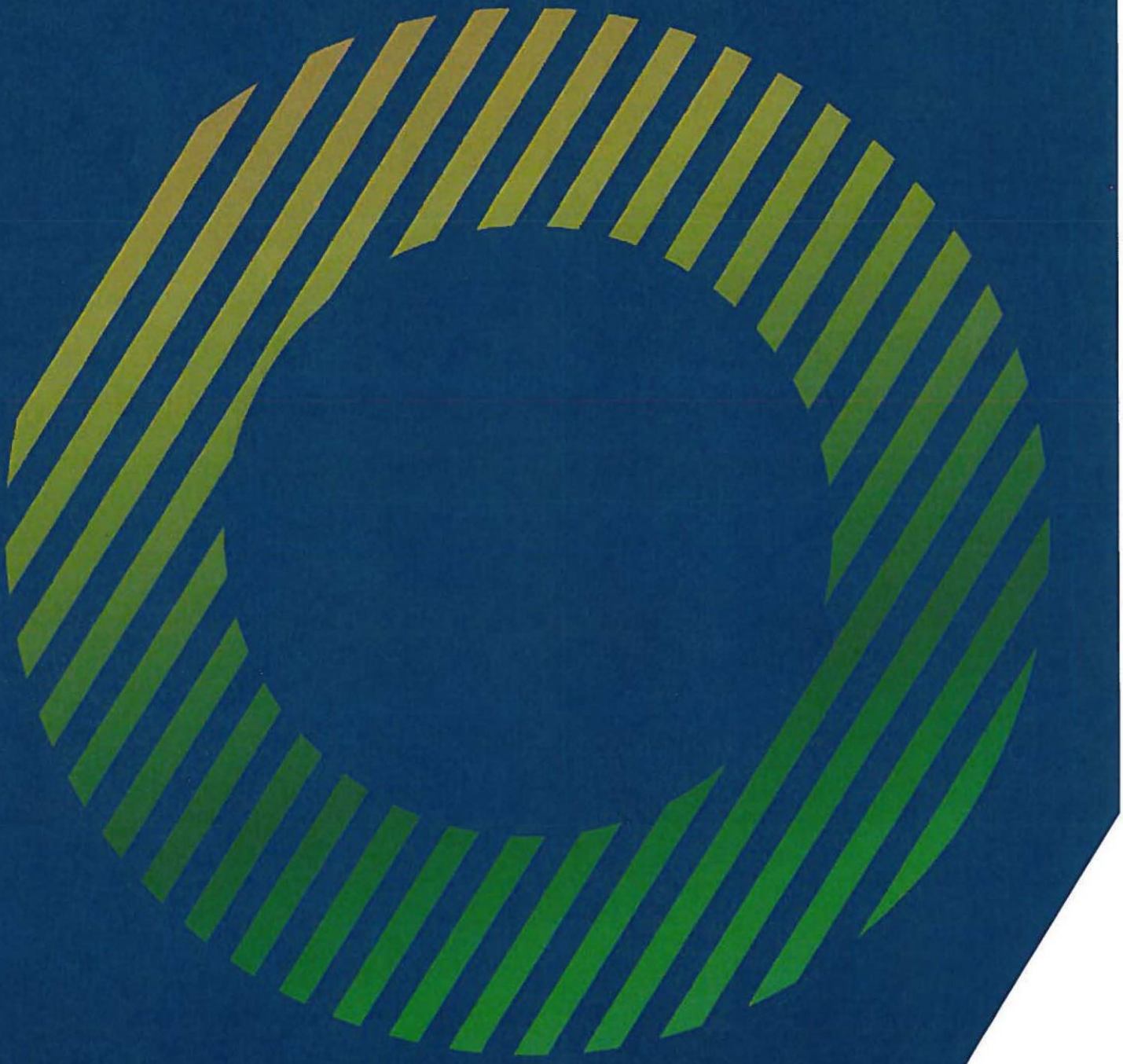
Sen. Barbara Boxer, Chairman
Committee on Environment and Public Works

Sen. Sheldon Whitehouse, Chairman
Subcommittee on Clean Air and Nuclear Energy

Dan Utech, Special Assistant to the President for Energy and Climate Change

Attachment 1



SECRETARY-GENERAL'S REPORT TO MINISTERS 2014

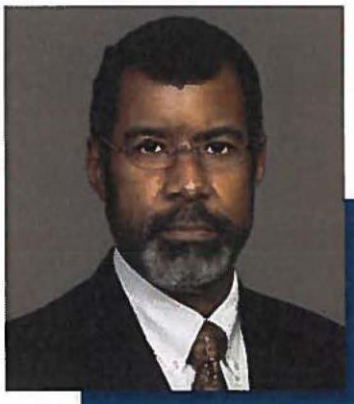
OECD
BETTER POLICIES FOR BETTER LIVES

Secretary-General's Report to Ministers

2014

BETTER POLICIES FOR BETTER LIVES

Nuclear Energy Agency



William Magwood*
Director-General

The Nuclear Energy Agency (NEA) is a specialised agency within the OECD. Its 31 member countries account for 90% of global nuclear energy generating capacity. Through international co-operation, the NEA helps its member countries maintain and further develop the scientific, technological and legal bases required for a safe, environmentally friendly and economical use of nuclear energy for peaceful purposes. It provides input to government decisions on nuclear energy policy and to broader OECD policy analyses in areas such as energy, green growth and climate change.

NEA activities are carried out in the areas of nuclear safety and regulation, radioactive waste management, radiological protection, nuclear science and data, nuclear development and the fuel cycle, and legal affairs. In addition, the NEA acts as the technical secretariat of two important international initiatives: the Multinational Design Evaluation Programme, which aims to enhance co-operation among regulators on safety design reviews of new reactors, and the Generation IV International Forum, which is co-ordinating members' R&D efforts for the next generation of nuclear energy systems.

In September 2013, the NEA published *The Fukushima Daiichi Nuclear Power Plant Accident: OECD/NEA Nuclear Safety Response and Lessons Learnt*. The report outlines international efforts to strengthen nuclear regulation, safety, research and radiological protection in the post-Fukushima context. It also describes work on new reactors and legal frameworks, and highlights key messages and lessons learnt, notably as related to assurance of safety, shared responsibilities, human and organisational factors, defence-in-depth (DiD), stakeholder engagement, crisis communication and emergency preparedness. International joint projects are being carried out under NEA auspices on related nuclear safety and plant decommissioning issues.

The NEA continued its expansion and outreach in 2013. It pursued in particular the integration of the Russian Federation as its newest member. It also expanded its areas of co-operation with India and signed a Joint Declaration on Co-operation in the Field of Peaceful Uses of Nuclear Energy with the China Atomic Energy Authority. ■

For more information see: **www.oecd-nea.fr**

* Mr. Magwood will take up his duties on 1st September 2014.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

OFFICE OF THE
INSPECTOR GENERAL

September 17, 2009

MEMORANDUM TO: Chairman Jaczko

FROM: Hubert T. Bell
Inspector General

SUBJECT: ALLEGED CONFLICT OF INTEREST BY FORMER NRC COMMISSIONER (CASE NO. 07-63)

This memorandum conveys the results of an Office of the Inspector General (OIG) investigation of former Commissioner Jeffrey Merrifield's employment-seeking activities from October 2006, when he announced he would not seek a third term, until June 30, 2007, his last day as Commissioner. OIG initiated this investigation after the Project on Government Oversight (POGO) alleged that Merrifield's post-NRC employment with The Shaw Group Incorporated (Shaw) constituted a conflict of interest. POGO alleged that in 2007, during his last months as Commissioner, Merrifield was involved with policy initiatives that benefitted Shaw in particular and the nuclear industry in general. Specifically, POGO provided two examples: Merrifield's involvement in the "Limited Work Authorizations" rule and his position as Chair of NRC's Combined License Review Task Force.

I. Ethics Requirements

The criminal conflict-of-interest law 18 U.S.C. 208(a) prohibits Federal employees from participating personally and substantially in any Government matter that the employee knows could have a direct and predictable effect on the financial interest of the employee; the employee's spouse or minor child; an organization which the employee serves as officer, director, employee, general partner, or trustee; or anyone with whom the employee is negotiating or has an arrangement for employment. This law requires employees to disqualify themselves from participating in any Government matter if the matter could affect any of these prohibited interests.

The Ethics in Government Act of 1978, as amended, and Title 5, Code of Federal Regulations, Part 2634, requires that each year, Federal Government employees whose positions are classified as GS-15 or above file a Standard Form (SF) 278. The SF 278 requests information on the employee's assets and liabilities, including non-Government travel-related reimbursements that exceed $260 from any one source. The form also

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requires individuals to report information on negotiations for future employment from the point at which the employee and potential non-Federal employer have agreed to the employee's future employment by the employer, regardless of whether all terms have been settled.

II. Chronology of Merrifield's Employment-Seeking Activities

On October 20, 2006, Merrifield announced to the White House and to then Chairman Dale Klein that he would not seek a third term as Commissioner and would step down from his position on June 30, 2007.

On October 25, 2006, Merrifield met with George Mulley, Senior Level Assistant for Investigative Operations, OIG, and John Szabo, NRC Ethics Counselor, Office of the General Counsel (OGC), to convey his intent not to seek a third term and describe arrangements he had made with Steve Engelmyer, an attorney and friend of Merrifield, to serve as an intermediary between Merrifield and potential future employers. Under this arrangement, Engelmyer would field all prospective employment offers for Merrifield, and Merrifield would not discuss employment with anyone except Engelmyer until he completed his term. If Engelmyer informed Merrifield about a possible position, Merrifield would consult with OGC staff to take appropriate action to avoid violating the ethics rules. Merrifield requested Mulley's presence at this meeting because he wanted Mulley to understand his job search strategy in case OIG received allegations concerning this arrangement.

Also on October 25, 2006, Merrifield informed his staff via office memorandum that he would not be seeking a third term and that he had retained the services of an outside counsel to handle any employment inquiries. The memorandum instructed his staff that if they received any inquiries, they were to forward them through Spiros Droggitis, Merrifield's Executive Assistant, or John Thoma, Merrifield's Chief of Staff, who would forward the inquiries to the outside counsel. The memorandum also directed that Merrifield should not receive information concerning these inquiries so that he could continue his current duties without an actual or apparent conflict of interest.

Subpoenaed documents[1] indicate that Engelmyer served as an intermediary between Merrifield and potential employers until spring 2007, at which point Merrifield began communicating directly with companies over potential employment opportunities. OIG learned that in spring 2007, Merrifield contacted a senior Exelon official to discuss employment opportunities in the nuclear industry. The Exelon official later had several conversations with Engelmyer and suggested that Engelmyer contact Westinghouse, General Electric (GE), Areva, Shaw, Bechtel, and possibly Holtec. At one point, Merrifield contacted the Exelon official to ask if he could call Shaw and GE on Merrifield's behalf because these companies were not returning Engelmyer's

[1] As part of this review, OIG subpoenaed records from Progress Energy, Westinghouse Nuclear International, Shaw, Holtec, Energy Solutions, Exelon Corporation, GE Hitachi Nuclear Energy, GE Energy, and Verizon to ascertain if Merrifield had violated any ethics regulations.

telephone calls. The Exelon official did not recall when Merrifield requested him to contact these companies on his behalf; however, he later telephoned Shaw and GE senior officials to recommend that they consider Merrifield for employment.

Between April 26 and June 30, 2007, Merrifield had direct communication with four nuclear industry vendors and one reactor licensee to discuss employment opportunities, and he traveled to Pittsburgh, Pennsylvania; Schenectady, New York; and Charlotte, North Carolina, for employment interviews. During this period, Merrifield received job offers from four of the companies. Table 1 indicates the date ranges during which Merrifield negotiated employment with the four companies.

Table 1. Merrifield Employment Negotiation Date Ranges[2]

Name of Company	Start Date	End Date
Shaw	04/26/2007	06/25/2007
Westinghouse	05/16/2007	06/20/2007
GE	05/24/2007	06/25/2007
Holtec	06/06/2007	06/20/2007

III. Merrifield's Voting Record and Direct Involvement in Employment Negotiations

OIG reviewed Commission Voting Records (VR) and Commission Adjudicatory Orders for January 1 through July 31, 2007, to determine which matters were before the Commissioner for a formal decision and the dates these matters were before the Commissioner.[3] Based on this review, OIG identified 27 final decisions which Merrifield participated in that could benefit specific entities or an identifiable class of entities that are either (1) licensees or (2) licensee contractors. These decisions covered a wide range of topics, including design basis threat, fitness for duty, reactor license renewals, and early site permits. OIG identified specific entities and identifiable classes of entities that could potentially benefit, including (1) entities active in or seeking nuclear plant design and construction business, (2) power plant licensees, (3) operators of plants in multiple degraded cornerstone category, (4) entities active in or seeking In-Situ design,

[2] OIG identified these periods based on its review of subpoenaed documents. OIG considered negotiations to start when Merrifield began communicating directly with a company over potential future employment and to conclude when Merrifield's communication with the companies ended. Although Merrifield accepted Shaw's employment offer on June 21, 2007, he continued to negotiate with Shaw after that date and did not decline GE's offer until June 25, 2007.

[3] Commissioners express explicit and binding actions primarily through two mechanisms. Commissioners vote on internal policy proposals from the staff as expressed in SECY papers or as proposed from other Commissioners through COM papers. The other means by which Commissioners express explicit and binding action is through their adjudicatory function as the appellate body for the Atomic Safety and Licensing Board Panel. The NRC Commissioners each express their opinion as part of a majority opinion and they can also express their individual opinions as part of a dissent or agreement with the majority decision with differing views.

construction, and operation business; and (5) entities active in AP 1000 plant design and construction business in the Chinese market.

OIG compared the date ranges of Merrifield's involvement in these Commission decisions with the date ranges in Table 1. OIG noted there were two time periods when Merrifield's employment negotiations with three companies overlapped with his involvement in votes that could affect the financial interest of the companies. Table 2 shows the two periods of overlap. The specifics of the two overlapping time periods and companies are described below.[4]

Table 2. Merrifield Employment Negotiation and SECY Votes

Name of Company	Description	Initial Date	Vote Date
Shaw	SECY 07-0076, Proposed Plan for Cooperation with China on the AP 1000	04/30/2007	05/7/2007
GE/ Westinghouse	SECY 07-0082, Rulemaking to Make Risk-Informed Changes to Loss-of-Coolant Accident Technical Requirements	05/16/2007	06/19/2007

a. SECY 07-0076: Shaw

OIG determined that Merrifield had SECY 07-0076, "Proposed Plan for Cooperation with China on the AP 1000," under consideration while he was directly involved in employment negotiations with Shaw. According to SECY 07-0076, the Chinese government had entered into a memorandum of understanding with the U.S. Department of Energy for the purchase of AP 1000 reactors. To the extent that the government-to-government agreement can improve the foreign or domestic marketing position of the AP 1000, then the AP 1000 consortium – composed of Shaw, Westinghouse, and Mitsubishi[5] – would benefit.

[4] POGO's allegation provided two specific examples of Merrifield's activities that in their view posed a conflict: Merrifield's involvement in the "Limited Work Authorizations" rule and his position as Chair of NRC's Combined License Review Task Force. OIG found that the Commission reached its decision concerning SECY 07-0030, "Final Rulemakings for Limited Work Authorizations," on March 22, 2007, and that Merrifield's involvement in the Combined License Review Task Force covered the time period from November 2006 through April 18, 2007. Based on subpoenaed documents and interviews, OIG did not identify any direct involvement by Merrifield in any employment discussions with any company prior to April 26, 2007; therefore, the examples provided by POGO were outside of the period during which Merrifield was negotiating for employment.

[5] These companies developed the technology and constructed the AP 1000. As part of SECY 07-0076, a Memorandum of Cooperation between the NRC and its Chinese counterpart, established areas of cooperation on the AP 1000, including sharing of all associated regulatory documents; exchange of regulatory and technical personnel for on-the-job training in design review, construction inspection, and inspection on the AP 1000; and access to the majority of the NRC's safety codes.

SECY 07-0076 was issued by the staff to the Commissioners on April 30, 2007, and Merrifield voted on this SECY on May 7, 2007. Merrifield was directly involved in employment discussions with Shaw from April 26 through June 25, 2007. The overlapping time period was April 30 through May 7, 2007.

OIG learned that Shaw expected to benefit from the AP 1000 market in China through an ownership interest in Westinghouse.[6] Shaw's October 2006 10-K[7] filing with the U.S. Securities and Exchange Commission states that Shaw had obtained exclusive rights to perform engineering, procurement, and construction services for AP 1000 nuclear projects. The filing states that Shaw had been working with Westinghouse on four new reactors proposed in China. The filing also states, "Growth in the global nuclear power sector is anticipated, driven in large part by China and India. Our support of existing U.S. utilities coupled with our investment in Westinghouse in collaboration with Toshiba is anticipated to result in increased activity in this sector."

OIG also learned that Merrifield was aware that Shaw and Westinghouse had worked together since at least 2005 to develop the AP 1000 for the Chinese market. On August 26, 2005, the Director of NRC's Office of International Programs transmitted SECY 05-0154, "Proposed 10 CFR Part 810 Authorization for Shaw Group, Inc. to Transfer Nuclear Reactor Technology and Services to the Chinese Civilian Nuclear Power Program," to the NRC Commissioners, including Merrifield. SECY 05-0154 states that Commission approval was sought to allow Shaw and its affiliates to transfer nuclear reactor technology to the People's Republic of China.

SECY 05-0154 states that Commission approval would allow Shaw to provide a full range of services for the AP 1000 in China and to prepare the Chinese to operate the completed reactors. It would also enable Shaw to provide its technology and services to other Chinese nuclear plants and projects. According to SECY 05-0154, Shaw was a member of the Westinghouse-led consortium bidding to build four Westinghouse-designed AP 1000 reactors in China. On August 31, 2005, Merrifield voted on SECY 05-0154, approving without comment Shaw's transfer of nuclear reactor technology to China.

b. SECY 07-0082: General Electric and Westinghouse

Merrifield had SECY 07-0082, "Rulemaking to Make Risk-Informed Changes to Loss-of-Coolant Accident Technical Requirements," under consideration while he was directly involved in employment negotiations with Westinghouse and GE. SECY 07-0082 requested Commission guidance regarding risk informed acceptance criteria for emergency core cooling currently in 10 CFR 50.46(a), "Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors." Westinghouse and GE are nuclear steam system suppliers and nuclear fuel suppliers. Both companies provide a wide range of engineering consulting services, including

[6] In October 2006, Shaw acquired a 20-percent interest in Westinghouse.

[7] A Form 10-K is an annual report required by the U.S. Securities and Exchange Commission that provides a comprehensive summary of a public company's performance.

loss-of-coolant-accident analysis, new reactor emergency core cooling system (ECCS) design, and analytical support for power uprates. Westinghouse and GE would benefit from promulgation of the new risk-informed ECCS criteria if current or future clients requested work to implement the new criteria for operating or new reactors.

On May 16, 2007, the staff submitted SECY 07-0082 to the Commission and on June 19, 2007, Merrifield voted on this SECY. OIG noted that Merrifield was directly involved in employment negotiations with Westinghouse from May 16 through June 20, 2007, and with GE from May 24 through June 25, 2007. The overlapping period for his negotiations with Westinghouse was May 16 through June 19, 2007. The overlapping period for his negotiations with GE was May 24 through June 19, 2007.

IV. Interview of Merrifield

On September 5, 2007, OIG referred this case to the Department of Justice, U.S. Attorney's Office, Southern Division, State of Maryland. On December 9, 2008, Assistant U.S. Attorney Steven Dunne interviewed Merrifield in the presence of his attorneys and OIG investigators. On December 22, 2008, the U.S. Attorney's Office declined prosecution of this case.

During the December 9th interview, Merrifield said that he had known Engelmyer since working for the Senate and that Engelmyer agreed to be his agent because of their friendship. Merrifield said that to avoid the appearance of a conflict of interest, he and Engelmyer discussed establishing a "firewall" to preclude direct negotiations between Merrifield and prospective employers. All employment offers were to be forwarded and screened by Engelmyer. According to Merrifield, he and Engelmyer discussed this arrangement with Szabo and how to handle employment negotiations.

Merrifield stated that after deciding not to seek a third term as Commissioner, he met with his staff to inform them of his planned departure. He also sent a memorandum to his staff instructing them that all potential job offers were to be forwarded and screened by Engelmyer.

Merrifield stated that Engelmyer never told him about potential employers he had communicated with on Merrifield's behalf. He stated that he did not plan to negotiate with any prospective employers while the firewall was in place. However, when Engelmyer's attempts to speak to potential employers on Merrifield's behalf did not succeed, Merrifield began having employment discussions directly with potential employers.

Merrifield said that once he entered into employment discussions with a company, he personally prepared a recusal memorandum for the company.[8] He recalled preparing four separate recusal memoranda for the following companies: Shaw, Westinghouse, Public Service Enterprise Group (PSEG), and Progress Energy. Following the development of the recusal memoranda, Merrifield provided his resume to potential employers. He recalled that each time he entered into employment discussions with a company, he also provided a verbal recusal to his staff. He stated that Szabo, Thoma, and (b)(7)c who served on Merrifield's staff as (b)(7)c knew about his recusals and that he sometimes informed Szabo directly about the recusals, or would have Thoma make notifications to (b)(7)c According to Merrifield, Szabo, Thoma, and (b)(7)c screened all issues regarding Shaw. He also recalled asking Szabo, Thoma, and (b)(7)c to screen all votes coming before the Commission.

Merrifield also said that he recused himself from any issue and/or rulemaking that may have had an impact on any company with which he was negotiating employment. However, he said that during the 2-month period prior to his departure, there were no major issues before the Commission that affected licensees or vendors.

Merrifield advised that he received employment offers from Shaw, Westinghouse, GE, and Holtec. After considering all offers, he believed that Shaw would be the best fit for him and accepted its offer on June 21, 2007. (Note: Although Merrifield prepared recusal memoranda for Shaw, Westinghouse, and GE, he voted on SECY 07-0076 and 07-0082 while negotiating employment with these companies.)

V. Interview of Szabo

Szabo told OIG that he first learned of Merrifield's arrangement with Engelmyer on June 1, 2006, when Szabo met with Merrifield and participated in a conference call with Engelmyer. During the conference call, Szabo explained various restrictions on Government employees looking for employment, including conflict-of-interest rules. During the discussion, Szabo also explained to Merrifield that to avoid a conflict, Merrifield could not discuss possible employment with any potential employer if Merrifield was working on a matter at the NRC that could affect that employer.

Szabo provided Merrifield with two options to avoid conflicts: (1) telling any company wishing to discuss employment that could be affected by his NRC activities that he could not discuss employment with them and terminating the discussions, or (2) continuing employment discussions, but recusing himself from participating in any NRC actions or activities that might relate to the company. Szabo told OIG that recusal means the Commissioner should "stay away" or "disqualify himself" from anything where a party has a financial interest. For a Commissioner, Szabo said this means do not vote and do not direct the staff to do anything on the issue. Szabo further stated

[8] Each recusal memorandum generally stated that Merrifield instructed Thoma to preclude his participation in all matters associated with each company, and to work with Szabo to resolve any issues concerning his job search.

[9] Formerly (b)(7)c

that he had several conversations with Merrifield about ethics requirements relating to conflicts of interest and Merrifield's job search. Szabo said it was clear to him that Merrifield understood the legal advice Szabo provided on this issue.

Szabo stated that in March 2007, he provided Merrifield a generic recusal letter that Merrifield could use to document any recusals. At the time, Szabo believed that Merrifield was not having much activity or success in his job search, but that Merrifield wanted to protect himself if and when that changed. However, Szabo said that Merrifield was not required to show his letter of recusal to anyone. He said it was Merrifield's decision to prepare a recusal memo and whether to give a copy of the recusal memo to his staff. Szabo said that regardless of the means by which Merrifield chose to have his staff assist with his recusal, it was Merrifield's personal responsibility not to act on matters that could financially benefit companies with whom he was negotiating employment.

Szabo said that on May 17, 2007, (b)(7)c called him for advice on SECY-07-0076, involving cooperation with China on the AP 1000 reactor design. Szabo provided OIG with a memorandum he had prepared documenting his discussion with (b)(7)c As reflected in the memorandum, Szabo stated that (b)(7)c told him that Merrifield was discussing employment with Shaw and that (b)(7)c informed him that Shaw owned a portion of Westinghouse. Because Westinghouse had an interest in and involvement with the AP 1000 reactor design, Szabo recommended that Merrifield not make any recommendations or vote on this SECY paper.

OIG informed Szabo that Merrifield had voted on SECY 07-0076 on May 7, 2007, and asked if he and (b)(7)c had discussed the fact that Merrifield had already voted during their May 17, 2007, discussion. Szabo said he was unaware that Merrifield had already voted on the SECY. He said that it made no sense for (b)(7)c to have contacted him about Merrifield's involvement in SECY-07-0076 after Merrifield had already voted on the SECY. Szabo said he did not know that Shaw owned 20 percent of Westinghouse until (b)(7)c advised him of this because Merrifield was discussing employment with Shaw. He recalled that after this conversation with (b)(7)c he confirmed that Shaw did, in fact, have an interest in Westinghouse.

Szabo stated that on May 23, 2007 (b)(7)c contacted him regarding a fitness-for-duty rule before the Commission. The rule pertained to the firm Progress Energy. (b)(7)c told him that Merrifield had discussed employment with Progress Energy, but these discussions had terminated. Based on this termination, Szabo told (b)(7)c he had no objections to Merrifield's involvement with the fitness-for-duty rule. According to Szabo, he had no other contact with Merrifield or his staff regarding his job search. He never received copies of any recusal letters or indications of other concerns.

Szabo told OIG that Merrifield's vote on SECY 07-0076 while he was negotiating with Shaw appears to have been a conflict of interest. However, he said that additional information would be needed to definitively reach this conclusion because the issue is

technically complex. Szabo acknowledged that if SECY 07-0076 had a financial impact on either Westinghouse or Shaw, then Merrifield should have disqualified himself from voting on SECY 07-0076.

Szabo could not determine whether Merrifield's vote on SECY 07-0082 during the time he was negotiating with Westinghouse and GE was a conflict of interest. He said that to determine whether a conflict of interest had occurred, he would need information from the staff on how Merrifield's vote may have affected the financial interests of each company.

VI. Interviews of Merrifield's Staff

OIG interviewed former Merrifield staff members, including Thoma, Droggitis, and (b)(7)c who each stated that they were aware of Merrifield's arrangement with Engelmyer and were instructed not to forward information related to potential job opportunities to Merrifield. If such inquiries were received, Thoma or Droggitis were to forward the information to Engelmyer.

Thoma said that in approximately November 2006, he learned that Merrifield was leaving Government service when Merrifield issued a memo to his staff about a job search arrangement he had made with Engelmyer. Thoma said that Merrifield told him that he had been working with Szabo to establish an arrangement that entailed Engelmyer handling all details and offers relating to Merrifield's job search. Thoma recalled that only one letter with a job offer came to the office prior to Christmas 2006. Merrifield told Thoma very little about the details of his job search. However, in the spring of 2007, Merrifield told Thoma he was going to start "reaching out" more to companies about potential jobs. Thoma also stated that Merrifield told him about seven or eight companies with which he was negotiating, including Westinghouse, Shaw, and Holtec.

Droggitis said he had the sense that there was no progress with Merrifield's job search until the last month or two of his term. The only item Merrifield was involved in where Droggitis thought there was the possibility of a conflict of interest involved an agreement with China (SECY 07-0076) that was related to nuclear reactors produced by Westinghouse. The proposed agreement was to exchange safety information with the Chinese Nuclear Regulatory Agency. Droggitis recalled discussing the issue with (b)(7)c and possibly Szabo, who informed him that because Merrifield had already voted, Droggitis could complete the administrative actions necessary to finalize the vote; however, he should not involve Merrifield in any Staff Requirements Memorandum (SRM) developed subsequent to the vote.

(b)(7)c said that Merrifield wanted to serve out his term as an active Commissioner, and that he did not want to generally recuse himself from NRC actions. She said the rationale for Merrifield's meeting with Szabo and OIG was to discuss an arrangement

that prevented the violation of conflict-of-interest regulations, but allowed Merrifield both to remain an active member of the NRC and pursue post-Government employment.

(b)(7)c said that Merrifield's involvement in employment negotiations began in April 2007. She recalled that Merrifield negotiated potential employment with four firms: Shaw, Westinghouse, Progress Energy, and possibly GE. However, (b)(7)c never reviewed any written record of Merrifield's interaction with specific potential employers or any written recusals. She saw no reason to document the recusals. (b)(7)c said that once she learned of Merrifield's active involvement in a job search with a particular firm, she would review upcoming issues to help ensure that Merrifield remained isolated from potential conflicts of interest. However, she said that a formalized process was never established for Merrifield and his staff to identify and evaluate potential conflicts of interest. The communication between Merrifield and his staff on potential conflicts of interest was always verbal and may have come to her from either Thoma or Merrifield.

(b)(7)c recalled having a telephone conversation with Szabo on May 17, 2007. She said she called Szabo to discuss (1) the administrative process for issuing an SRM for SECY 07-0076 and (2) the fitness-for-duty rule before the Commission. (b)(7)c recalled that the fitness-for-duty rule had a direct effect on Progress Energy, a company with which Merrifield had discussed future employment, but had since terminated discussions. (b)(7)c did not recall discussing Merrifield's employment negotiations with Shaw during the May 17 telephone conversation. (b)(7)c did not recall telling Szabo that Shaw owned a 20-percent interest in Westinghouse during the discussion. She said she did not know that Shaw had a 20-percent interest in Westinghouse when Merrifield voted on SECY 07-0076.

According to (b)(7)c she did not tell Szabo that Merrifield had already voted on SECY 07-0076 because she did not make the connection between Shaw and Westinghouse. (b)(7)c stated that if she had thought there were a conflict of interest with Merrifield's vote on SECY 07-0076, she would have brought it to Szabo's attention. She also stated that any benefit to Shaw would have been tenuous. Furthermore, she said SECY 07-0076 was approved by every member of the Commission and would have passed whether Merrifield voted or not.

VII. Review of Merrifield's SF 278

As part of this investigation, OIG reviewed Merrifield's SF 278 dated July 3, 2007, for the period January 1, 2006, through June 30, 2007, to determine whether he accurately reported information related to his job search. OIG compared subpoenaed records to Merrifield's SF 278 and found that Merrifield did not disclose on his SF 278, Schedule B, Part II, "Gifts, Reimbursements, and Travel Expenses," his travel reimbursement requests totaling $3,552.47, which he made to GE and Shaw. The first request, for $636.60, was made to GE, in connection with Merrifield's June 14, 2007, trip to

Schenectady, New York, to meet with company executives to discuss potential post-NRC employment opportunities. The second reimbursement request not reflected on his SF 278 was made to Shaw for $2,915.87, in connection with Merrifield's June 26-30, 2007, visit to Charlotte, North Carolina, with his family to meet with Shaw executives after he accepted a job offer from the company on June 21, 2007. Although Merrifield submitted a voucher to Westinghouse for reimbursement for travel to Pittsburgh, Pennsylvania, in connection with possible employment, Merrifield was not required to list this on his SF 278 because the amount reimbursed ($250.80) did not meet the required threshold of $260 for the SF 278.

OIG also noted that Merrifield did not disclose on his SF 278, Schedule C, Part II, "Agreements or Arrangements," his employment agreement with Shaw even though Merrifield accepted Shaw's job offer on June 21, 2007, which fell within the time period covered by the form.

Merrifield stated that he did not fill out Schedules B and C of the SF 278 regarding reimbursements and agreements because "it just went over my head." The issue concerning the reimbursement for travel expenses did not come to his attention until James Bensfield, his attorney, spoke with Assistant U.S. Attorney Dunne regarding this issue. Merrifield stated that he did not intentionally omit any information from his SF 278.

On August 24, 2009, subsequent to his December 9, 2008, interview with Assistant U.S. Attorney Dunne, Merrifield submitted an amended SF 278, Schedules B and C, to include previously omitted information concerning his non-Government travel-related reimbursements from Shaw and GE and his employment agreement with Shaw.

VIII. Conclusions

OIG determined that Merrifield did not take effective measures to prevent a potential conflict of interest during the last 2 months of his term. Although Merrifield set up an arrangement to pursue post-Government employment via a third party while serving as Commissioner, Merrifield stopped following this arrangement prior to the end of his term and began negotiating directly with potential employers. At this point, Merrifield did not establish a process to ensure a thorough screening of and recusal from matters before the Commission. Although Merrifield was ultimately responsible for exercising his recusal, he also relied on his staff to screen matters that involved potential employers with whom he was negotiating employment. However, Merrifield did not provide his staff with necessary details of his job search or establish a process for evaluating matters before the Commission to ensure he disqualified himself from involvement with potential conflict of interest issues. Moreover, his staff did not effectively screen matters to assist him in exercising his recusal option.

OIG determined that from April 2007 until June 2007, Merrifield was directly involved in employment negotiations with three companies – Shaw, Westinghouse, and GE – that could have potentially benefitted financially from his votes on SECY 07-0076, involving the AP 1000 China agreement and SECY 07-0082, pertaining to loss-of-coolant accident rulemaking. These votes occurred during the specific timeframes in which Merrifield was negotiating with the three companies.

OIG found that Merrifield did not report on his July 2007 SF 278 required information related to his acceptance of Shaw's job offer and his non-Government travel-related reimbursements totaling $3,552.47 from Shaw and GE.

This memorandum is furnished for whatever action you deem appropriate. Please notify this office within 120 days of what action, if any, you take based on the memorandum.

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(b)(7)c		R.Raspa	J. McMillan	D.Lee	H.Bell
9/ /09	9/ /09	9/ /09	9/ /09	9/ /09	9/ /09

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

September 28, 2010

OFFICE OF THE
INSPECTOR GENERAL

9/28/10
Concur: Case Closed

MEMORANDUM TO: Joseph A. McMillan
Assistant Inspector General
for Investigations

THRU: (b)(7)(C)

FROM:

SUBJECT: POTENTIAL CONFLICT-OF-INTEREST VIOLATION OF ETHICS REQUIREMENTS BY FORMER COMMISSIONER KLEIN (OIG CASE NO. 10-39)

Allegation

The Office of the Inspector General (OIG), U.S. Nuclear Regulatory Commission (NRC), initiated this investigation based upon a news article in the *Energy Daily* that reflected former NRC Commissioner Klein had accepted appointments to the board of directors for Pinnacle West Capital Corporation and its subsidiary, Arizona Public Service Company, the owners of Palo Verde Nuclear Generating Station.

During the investigation, OIG learned that Klein had also joined the board of directors for Southern Company, the owner of Farley, Hatch, and Vogtle nuclear power plants, which are regulated by the NRC. Klein joined the board of directors within 1 year of resigning from Federal Government employment with the NRC and in so doing may have violated Federal post-employment regulations and conflict-of-interest statutes.

Findings

OIG found that Klein's acceptance of board-of-director appointments did not violate Federal post-employment regulations. Furthermore, OIG did not identify any evidence that Klein violated conflict-of-interest statutes by considering post-employment offers made to him by private companies while still employed at NRC.

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Basis of Findings

In accordance with18 United States Code (U.S.C.), Section 207, "Restrictions on former officers, employees, and elected officials of the executive and legislative branches," all former NRC employees, including special governmental employees (SGE) and supervisors, are subject to Federal post-employment restrictions. These restrictions prohibit NRC employees, SGE, and supervisors from ever representing, with intent to influence, a non-Federal party to a Federal agency or court on any "particular matter involving specific parties" in which the former employee personally and substantially participated as a Government employee. The law also restricts former supervisors for 2 years from representing, with intent to influence, a non-Federal party to a Federal agency or court on any "particular matter involving specific parties" that was pending under their official responsibility during their last year of Government service. The law further restricts former senior employees for 1 year after termination of Federal service from representing, with intent to influence, a non-Federal party before their former agency on any matter on which official action is sought, even on matters that were not under the former official's responsibility.

NRC's post-employment restrictions mirror 18 U.S.C. 207 Federal prohibitions. According to the OGC Web site, 18 U.S.C. 207 is not intended to prevent private sector employment after an individual terminates Federal service. Instead, it restricts an individual from engaging in representational activities before NRC, after the individual has terminated Federal service.

Klein resigned from NRC on March 29, 2010, and returned to the College of Engineering, University of Texas, Austin (his previous employer), as the associate director of the university's energy institute, based upon having "return employment rights" with the university. In early June 2010, Klein joined the board of directors for Pinnacle West Capital Corporation and the board of its subsidiary, Arizona Public Service Company. In mid-July 2010, Klein joined the board of directors for Southern Company.

Roger Davis, Klein's former NRC legal advisor, told OIG that Klein had planned to return to the University of Texas after resigning from NRC and that Klein was very cognizant of conflict-of-interest issues. Klein wanted to return to the university to avoid any conflict of interest. Davis told OIG that Klein would not consider offers of employment that he received while employed as a Government employee so as not to violate or be perceived in violation of any regulations or statutes. He said that he arranged for Klein to receive training on post-employment restrictions from John L. Szabo, Senior Attorney, Ethics Counselor, Office of the General Counsel, NRC.

OIG reviewed e-mail correspondence between Klein and Szabo, which confirmed that Szabo provided guidance concerning post-employment stipulations and conflict-of-interest issues. OIG did not identify any correspondence that indicated Klein was potentially in violation of Federal regulations or statutes.

(b)(7)(E)

OIG interviewed the NRC Project Managers responsible for Palo Verde, Farley, and Hatch nuclear power plants about whether Klein had any dealings with either of the Project Managers since his resignation from NRC. Both Project Managers related that they had not had any dealings with or had received correspondence from Klein or representatives from the utilities regarding matters regulated by NRC since Klein was appointed to board of directors for the respective utilities.

Szabo told OIG that he personally counseled Klein about Federal post-employment and conflict-of-interest regulations and statutes. Szabo advised that Klein had not violated any Federal regulations or statutes by accepting positions on the board of directors for the aforementioned utilities.

Klein, now Vice President for Research, Energy Institute, Department of Mechanical Engineering, Corkrell School of Engineering, University of Texas, told OIG that based on his knowledge of potential violations of conflict-of-interest statutes by former NRC Commissioners, he decided simply not to address any prospective employment offers while at NRC. He said his decision was based on advice and counsel he received from Davis and Szabo and that he thought it best to return to the University of Texas before addressing prospective employment offers.

Because OIG did not identify any information that Klein may have violated Federal post-employment regulations or conflict-of-interest statutes, it is recommended that this investigation be closed to the files of this office.

STATEMENT OF COMMISSIONER WILLIAM D. MAGWOOD, IV
UNITED STATES NUCLEAR REGULATORY COMMISSION
TO THE HOUSE COMMITTEE ON ENERGY AND COMMERCE
SUBCOMMITTEE ON ENERGY AND POWER
MAY 7, 2014

Good morning Chairman Upton, Ranking Member Waxman, Chairman Whitfield, Congressman Green, and distinguished members of the Subcommittee. Thank you for the opportunity to appear before you today to discuss the U.S. Nuclear Regulatory Commission's Fiscal Year 2015 budget request and related policy issues.

As the Chairman's statement has already highlighted important aspects of our budget request and many of our ongoing activities, I will add only a few brief comments.

First, I note that in the three years since the Fukushima Daiichi accident in Japan, I have seen nothing that would make me question the safety of U.S. nuclear power plants. Since March 2011, we have analyzed a vast array of technical issues, debated numerous complex regulatory policies, and engaged in an open, public discussion about the lessons learned from the accident. After all that, the central conclusion reached by our Near-Term Task Force in the months after the accident remains inviolate: U.S. nuclear power plants are safe.

But I think it important to emphasize that the reason that our plants are safe is that we in the United States—both the regulator and the licensee community—place very high value on responding to operating experience. U.S. plants are safe because we learned from six decades of light water reactor operations and because we learned from Three Mile Island and 9/11. We could do no less in the case of the Fukushima experience.

We have taken clear, specific actions based on the lessons learned. I believe the changes we have made thus far are appropriate and balanced. I believe that steps we and our licensees have taken have already made U.S. plants more resilient and further enhancements will be completed over the next few years.

But the true challenges, I think, still lay ahead. We must respond to the lessons of Fukushima without allowing the tragedy of Fukushima to change what has made us successful in past. We must keep our balance. We must keep to the strong regulatory practices that have made the NRC the "gold standard" among the world's nuclear safety regulators. We must continue to apply quantitative analyses to guide our decision-making. We must ensure that we focus our attention and resources on matters of true safety significance and hazards that reflect realistic, though extreme, scenarios. In the post-Fukushima environment, with so much attention on regulatory issues that were once esoteric and obscure, this is harder than you might believe. I believe it will prove even more difficult in the future.

The best way to keep our balance is to integrate fully the management and implementation of post-Fukushima activities into our normal work as quickly as possible. We must also proceed aggressively with the staff's very important Risk Prioritization Initiative. This initiative, which grew from a concept originally proposed by Commissioner Apostolakis and me, holds the promise of a better, more effective and more efficient strategy of nuclear regulation.

I look forward to watching NRC's progress on these issues. As I think you know, I was the U.S. Government's candidate to serve as the next Director General of the OECD Nuclear Energy Agency, and I was selected formally for that position in March. I will take up that new post in September and will, therefore, step down from the Commission this summer.

Since this is most likely my final appearance as an NRC Commissioner before this Committee, I take the opportunity to thank you for the serious and thoughtful manner in which this panel has overseen the NRC's work during my tenure. I very much appreciate the fact that you care so deeply about the important issues under NRC's jurisdiction and that you have always engaged us with fairness and balance. We are a better regulator because of your oversight.

Thank you for the opportunity to appear before you today. I look forward to any questions you may have.

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Vol. 7 No. 11 | Mar 21, 2014

DOE PROVIDES MORE DETAILS OF FY 2015 NUKE ENERGY BUDGET REQUEST

Jeremy L. Dillon
RW Monitor
3/21/2014

The Department of Energy's Fiscal Year 2015 budget request includes $30 million to support DOE's nuclear waste management program, of which $24 million would come from the Nuclear Waste Fund, according to detailed budget documents released late last week. The Obama Administration is seeking to access the funds in the Nuclear Waste Fund to help off-set some off the costs of implementing pilot interim waste storage facilities. The request includes a proposal to 'reform' how the fund is used as a way to tap into the NWF's resources. The fund currently stands at approximately $36 billion, but can only be used for activities related to the construction of a repository at Yucca Mountain, as outlined in the Nuclear Waste Policy Act. "In FY 2015 Department is requesting $30 million, including $24 million from the Nuclear Waste Fund, to support preliminary generic process development and other non-R&D activities related to storage, transportation, disposal, and consent-based siting," the justification said. "Mandatory appropriations in addition to the discretionary funding are proposed to be provided annually beginning in 2018 to fund the balance of the annual program costs."

DOE's efforts to implement some of the major strategies outlined in its 'Strategy for the Management and Disposal of Used Nuclear Fuel and High-Level Waste' are limited due to the NWPA's strict adherence to only allowing movement towards Yucca Mountain. In an effort to circumvent these restrictions, DOE's FY15 waste management plans under the $30 million request include "continue developing plans for a consent-based siting process; maintain and expand the unified and integrated UNF database and analysis system to characterize the input to the waste management system; prepare for large-scale transportation of UNF and high-level radioactive waste to a pilot interim storage facility with focus on UNF at shutdown reactor sites; evaluate integrated approaches to storage, transportation, and disposal in the waste management system with an emphasis on

also warned against dis-incentivizing the proper disposal of disused sources. "However, the long-term solution to the disused source problem is to hold the licensees who have purchased and obtained the economic benefit from the sources responsible for the proper reuse, recycling, or disposal of the sources when they become disused," the report says. "To this end, the NNSA should ensure that its programs do not provide a disincentive for licensees to properly reuse, recycle, or dispose of disused sources in a timely manner."

The working group also recommended that new regulations from the Nuclear Regulatory Commission should go into effect to help aid the economic side of the problem. This new regulations would limit the storage of disused sources for two years before movement must occur. "The NRC and the Agreement States should develop a comprehensive regulation to limit the storage of disused sources to two years and authorize regulators to require the disposition of sources in storage for more than two years unless there is a demonstrated future use," the report says. "The inventories of disused sources at sealed source manufacturers, suppliers, and waste brokers should be reduced. The NRC should reconsider its decision to allow foreign sources that may not have a commercial disposal pathway to be imported. The financial needs of the Agreement States should also be addressed."

Need for More Type-B Casks

A lack of transportation options for the disused sources also contributed to the problem, the working group said. Type-B casks are in short supply, which also makes them more expensive to use due to their low supply. The NNSA should help ease this demand through steps to encourage the production of more casks, the group said. "NNSA should undertake a market analysis of the demand for Type B shipping containers and take additional steps to encourage the private sector to increase the supply of commercially available Type B shipping containers," the report says. "NNSA should identify several internationally-certified Type B shipping containers that would have widespread applicability to disused sources in the U.S. and submit applications to have these packages certified by NRC for domestic use. The NRC should continue to expeditiously review applications for Type B shipping containers. The NRC should aggressively notify licensees and the Agreement States well in advance of the expiration of shipping container certifications."

NRC COMMISSIONER MAGWOOD SET TO LEAVE COMMISSION FOR INTERNATIONAL AGENCY

Jeremy L. Dillon
RW Monitor
3/21/2014

Nuclear Regulatory Commission Commissioner William Magwood is leaving the NRC to serve as Director General of the Paris-based Organization for Economic Co-operation and Development's Nuclear Energy Agency. Magwood will be taking over the position in September, but according to the NRC, he has not yet set a departure date due to previous commissioner commitments in the coming months he would like to fulfill before leaving the NRC. "It is a tremendous honor to have been the U.S. Government's candidate for this position and to have been selected as the seventh Director General to lead the NEA since it was formed in 1958," Magwood said in a statement this week. "I have especially appreciated the strong support and encouragement I received from senior officials of the Administration to take on this assignment. When I join the NEA in September, I will take with me the vital lessons I have learned from my time at the finest safety regulator in the world—the U.S. Nuclear Regulatory Commission. I look forward to sharing those lessons with the international community and to continuing my service to the public in a new venue."

The OECD Nuclear Energy Agency, established in 1958, is an international organization with 31 member countries that organizes cooperation between the nations in areas like nuclear safety, waste management, and technology. According to a NEA internal announcement, Magwood will report to the Secretary-General in order to "advance his strategic orientations in the area of nuclear energy whilst providing leadership and direction to leverage the NEA's comparative advantage, and increase its visibility and relevance both within the OECD/NEA area and beyond." His responsibilities would also include "promoting horizontal work and fostering coordination between the NEA and other areas of the Organization as well as providing support for corporate priorities," the announcement said.

FORMER OPG EMPLOYEE ALLEGES CALCULATIONS OFF FOR POTENTIAL

ATTACHMENT B

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555

COMMISSIONER

July 14, 2014

Diane Curran
Harmon, Curran, Spielberg & Eisenberg, LLP
1726 M Street NW, Suite 600
Washington, DC 20036-4523

Dear Ms Curran:

I am writing in response to the letter dated June 18, 2014, from you and Mindy Goldstein, on behalf of 34 organizations, regarding my acceptance of an offer to serve as the Director-General of the Organisation for Economic Co-Operation and Development's Nuclear Energy Agency (NEA). Your letter requested my immediate resignation from the Nuclear Regulatory Commission (NRC), as well as my retroactive disqualification form all safety decisions made by the Commission since I became a candidate for the NEA position. I have carefully reviewed each of the points raised in your letter and have determined that no retroactive recusal is necessary and I will continue to fulfill all of my responsibilities as a Commissioner until I leave the agency.

In your letter, you argue that my resignation and retroactive recusal are necessary because, having accepted an offer of future employment from the NEA, I am "committed to an organization whose mandate to promote nuclear energy as well as the economic interests of its members is antithetical to the basic principles…that safety, not economics, must be the NRC's paramount consideration." You further argue that my current presence on the Commission is counter to the requirement that Federal judges must recuse themselves from a matter where their "impartiality might reasonably be questioned."

Although your request does not pertain explicitly to my adjudicatory duties as a Commissioner, there is a great deal of precedent regarding prior requests for the recusal of one or more Commissioners from particular adjudicatory matters.[1] I found that this precedent was useful in my consideration of your request.

In Commission practice, each individual Commissioner is charged with personally responding the requests for his or her own recusal, and such decisions are not appealable to the entire Commission.[2] Individual Commissioners traditionally do look to the standards applied to Federal judges when considering recusal requests.[3] Federal courts have held that "an agency official should be disqualified only where 'a disinterested observer may conclude' that the official

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[1] I note after receiving your letter, two motions requesting that I recuse myself from matters pending before the Commission in the Fermi Unit 3 Combined Operating License and Ft. Calhoun License Renewal proceedings were filed. I am responding to each of those motions separately.
[2] *See Pacific Gas & Elec. Co.* (Diablo Canyon Nuclear Power Plant, Units 1 & 2), CLI-80-6, 11 NRC 411 (1980).
[3] *In re Joseph Macktal*, CLI-89-14, 30 NRC 85, 91 (1989). *See also, Decision on the Motion of Nye County, Nevada, for Recusal/Disqualification of NRC Chairman Allison M. Macfarlane* (Sept. 9, 2013).

'has in some measure adjudged the facts as well as the law of a particular case in advance of hearing it.'"[4] Similarly, the NRC recognizes that a Commissioner should disqualify him or herself only if "a reasonable man, cognizant of all the circumstances, would harbor doubts about the judge's impartiality."[5]

I do not believe that a reasonable individual with a full understanding of the breadth and purpose of the activities at the NEA, which are all focused on information exchange and policy, would harbor doubts about my ability to continue to fulfill my responsibilities as a Commissioner in an impartial manner.

NEA is an agency within the Organisation for Economic Co-operation and Development (OECD), which was founded in 1961 with the mission "to promote policies that will improve the economic and social well-being of people around the world."[6] This mission is accomplished through the cooperation of OECD's 34 member nations from Europe, North and South America, and Asia.[7] The organization operates under a set of core values that include: objective, independent, and evidence-based analyses; encouraging open debate and a shared understanding of issues; challenging conventional wisdom; identifying and addressing long-term issues; and building credibility through trust, integrity, and transparency.[8]

The NEA's mission, as stated in its Strategic Plan, is:

> To assist its member countries in maintaining and further developing, through international co-operation, the scientific, technological and legal bases required for a safe, environmentally friendly and economical use of nuclear energy for peaceful purposes. To provide authoritative assessments and to forge common understandings on key issues as input to government decisions on nuclear energy policy and to broader OECD policy analyses in areas such as energy and sustainable development.[9]

This mission is overseen by NEA's 31 member countries. Membership includes countries with robust, mature nuclear energy programs (for example, the United States, Japan, and France); countries that are starting or expanding their nuclear energy programs (for example, Turkey and the Czech Republic); countries that are halting or reducing their nuclear energy programs (for example, Germany), and countries that do not have and are not developing commercial nuclear power programs (for example, Ireland and Italy). The NEA does not advocate any particular outcome, but, with the support of its member countries, focuses on facilitating policy analyses, sharing information and experience amongst its members, developing cooperative research projects, and developing consensus positions on technical issues, including those relevant to nuclear safety regulators around the world.[10]

The policy and technical decisions in which I have participated in the last few months—and in which I intend to participate fully through the end of my service as a Commissioner—have had and will have no impact on the NEA's financial health or even its future research or policy

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[4] *Nuclear Info. & Res. Serv. (NIRS) v. NRC*, 509 F.3d 562, 571 (D.C. Cir. 2007) (quoting *Cinderella Career & Finishing Sch., Inc. v. FTC,* 425 F.2d 583, 591 (D.C. Cir. 1970)).
[5] *Macktal*, 30 NRC at 91.
[6] http://www.oecd.org/about/. Last accessed July 14, 2014.
[7] *Id.*
[8] *Id.*
[9] The Strategic Plan of the Nuclear Energy Agency, 2011-2016 (Strategic Plan), at 15.
[10] *Id.*

activities. Similarly, future activities by the NEA will only affect future NRC licensing and safety activities if the NRC decides to adopt future NEA policy recommendations. Such a decision would be based on the NRC's usual regulatory procedures, including any necessary public input and interaction.

Courts have long held that "[a]dministrative officers are presumed objective and 'capable of judging a particular controversy fairly on the basis of its own circumstances.'"[11] It has been my duty since I began my tenure at the Commission to meet my quasi-adjudicatory duties by weighing the evidence and arguments impartially and basing each decision on the adjudicatory record and applicable law. So long as I remain an administrative officer of the NRC, I fully intend to continue to fully discharge my duties in a fair and impartial manner.

In your letter you also raised concerns regarding whether I was the U.S. Government's candidate for the position of Director-General and whether other Federal officials advocated for my appointment. It is true that I was the U.S. Government's candidate for the position at the NEA. Advocacy for candidates for positions in international organizations is handled by the Executive Branch. While generally aware of this process, I was not directly involved beyond completing the required application materials.

I have considered carefully both the arguments presented in your letter and the applicable legal standards. I find no basis for either my immediate resignation or my retroactive recusal and respectfully decline to do so. I remain fully committed to meeting my responsibilities as an NRC Commissioner for the remainder of my tenure.

Sincerely,

William D. Magwood, IV

[11] *NIRS*, 509 F3d at 572 (quoting *United States v. Morgan*, 313 U.S. 409, 421 (1941)).

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

COMMISSIONER:
William D. Magwood, IV

In the Matter of	)	
DTE ELECTRIC CO.	)	Docket No. 52-033-COL
(Fermi Nuclear Power Plant, Unit 3)	)	

DECISION ON THE MOTION OF BEYOND NUCLEAR FOR RECUSAL FROM PARTICIPATION IN DELIBERATIONS ON PETITION FOR REVIEW OF LBP-14-07

INTRODUCTION

On June 25, 2014, counsel for Beyond Nuclear filed a motion requesting that I recuse myself from participating in deliberations on "Intervenors' Petition for Review of LBP-14-07 (Ruling for Applicant on Quality Assurance)," currently before the Commission in the ongoing Fermi Unit 3 Combined Operating License (COL) proceeding.[1] This Motion is based on an assertion that, having accepted an appointment to serve as the Director-General of the Organisation for Economic Co-operation and Development's (OECD) Nuclear Energy Agency (NEA) effective September 1, 2014, I am no longer able to consider the pending appeal in an impartial manner and must, therefore, recuse myself. Having reviewed the bases presented in the motion, the applicable law, and the facts surrounding my appointment to the NEA, I deny the Motion.

[1] *Intervenors' Motion for Recusal of Commissioner Magwood from Participation in Deliberations on Petition for Review of LBP-14-07* (June 25, 2014) (Motion).

BACKGROUND

OECD was founded in 1961 with the mission "to promote policies that will improve the economic and social well-being of people around the world."[2] This mission is accomplished through the cooperation of its 34 member nations from Europe, North and South America, and the Asia-Pacific region.[3] The organization operates under a set of core values that include: objective, independent, and evidence-based analyses; encouraging open debate and a shared understanding of issues; challenging conventional wisdom; identifying and addressing long-term issues; and building credibility through trust, integrity, and transparency.[4]

The NEA is an agency within the OECD. Its mission, as stated in its Strategic Plan, is:

> To assist its member countries in maintaining and further developing, through international co-operation, the scientific, technological and legal bases required for a safe, environmentally friendly and economical use of nuclear energy for peaceful purposes. To provide authoritative assessments and to forge common understandings on key issues as input to government decisions on nuclear energy policy and to broader OECD policy analyses in areas such as energy and sustainable development.[5]

This mission is carried out by NEA's 31 member countries. Membership includes countries with robust, mature nuclear energy programs (for example, the United States, Japan, and France); countries that are starting or expanding their nuclear energy programs (for example, Turkey and the Czech Republic); countries that are halting or reducing their nuclear energy programs (for example, Germany), and countries that do not have and are not developing commercial nuclear power programs (for example, Ireland and Italy). The NEA, with the support of its member countries, focuses on facilitating policy analyses, sharing information and experience amongst

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[2] http://www.oecd.org/about/. Last accessed July 14, 2014.

[3] *Id.*

[4] *Id.*

[5] The Strategic Plan of the Nuclear Energy Agency, 2011-2016 (Strategic Plan), at 15.

its members, developing cooperative research projects, and developing consensus positions on technical issues, including those relevant to nuclear safety regulators around the world.[6]

Following the announcement of his planned retirement by former NEA Director-General Luis Echevaria, I became a candidate for the position of Director-General. In March 2014, it was announced that I would succeed Mr. Echevaria, and that I would begin my service at the NEA on September 1, 2014. In the meantime, I have continued to serve as a Commissioner at the NRC and have observed all applicable ethics guidelines.[7]

The Motion arises in the context of the Combined Operating Licensing proceeding for Fermi Unit 3. The Intervenors have appealed to the Commission an Atomic Safety and Licensing Board order on proposed Contention 15, which challenges quality assurance within the planning effort for the proposed unit. The Motion requests my recusal from consideration of the appeal on the grounds that my future service with the NEA is inconsistent with my present duties and reveals a bias or prejudice in favor of nuclear power.[8]

DISCUSSION

The primary argument presented in the Motion for the need for my recusal is that my ability to be impartial is in question.[9] Upon consideration of all the relevant facts and

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[6] *Id.*

[7] The Motion states "Commissioner Magwood holds employment outside the Commission" with the NEA. I feel it is important to clarify that, although I have accepted an offer of future employment with the NEA, I am not currently employed by the NEA. While I am still employed by the NRC, I am prohibited by Federal ethics law and regulations from carrying out any duties on behalf of NEA.

[8] Motion at 5.

[9] The Motion also implies that there is a financial link between the Fermi proceeding and the NEA. Motion at 3. The Motion notes both that "[s]ome of OECD's member governments own or sponsor U.S. nuclear licensees and applicants" and that the unit proposed to be built at Fermi—the General Electric-Hitachi Economic Simplified Boiling Water Reactor—has been discussed in NEA literature. 5 C.F.R. § 2635.606(a) states that a Federal officer "shall not participate personally and substantially in a particular matter that has a direct and predictable effect on the financial interests of the [organization] with whom he has an arrangement concerning future (Continued . . .)

circumstances, I conclude that a reasonable observer would not question my ability to act as an impartial adjudicator when considering the Intervenors' appeal.

In Commission practice, each individual Commissioner is charged with personally responding to requests for his or her own recusal, and such decisions are not appealable to the entire Commission.[10] Individual Commissioners traditionally look to the standards applied to Federal judges when considering recusal requests.[11] Federal courts have held that "an agency official should be disqualified only where 'a disinterested observer may conclude' that the official 'has in some measure adjudged the facts as well as the law of a particular case in advance of hearing it.'"[12] Similarly, the NRC recognizes that a Commissioner should disqualify him or herself only if "a reasonable man, cognizant of all the circumstances, would harbor doubts about the judge's impartiality."[13]

The Intervenors argue that my future employment with NEA marks a change from "safety regulator to that of an institutional advocate for expanded use of nuclear power."[14] This concern seems to be based on the portion of NEA's Mission Statement which says that the NEA "assist[s] its member countries in maintaining and further *developing*, through international cooperation, the scientific, technological and legal bases required for a safe, environmentally

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employment." That is not the case here. The simple fact that NEA—an organization of national governments that counts as a chief mission research—has discussed an emerging nuclear technology does not indicate a that there will be a direct and predictable impact on NEA's financial interests from the Fermi proceeding.

[10] *See Pacific Gas & Elec. Co.* (Diablo Canyon Nuclear Power Plant, Units 1 & 2), CLI-80-6, 11 NRC 411 (1980).

[11] *In re Joseph Macktal*, CLI-89-14, 30 NRC 85, 91 (1989); *see also Decision on the Motion of Nye County, Nevada, for Recusal/Disqualification of NRC Chairman Allison M. Macfarlane* (September 9, 2013).

[12] *Nuclear Info. & Res. Serv. (NIRS) v. NRC*, 509 F.3d 562, 571 (D.C. Cir. 2007) (quoting *Cinderella Career & Finishing Sch., Inc. v. FTC,* 425 F.2d 583, 591 (D.C. Cir. 1970)).

[13] *Macktal*, 30 NRC at 91.

[14] Motion at 5.

friendly and economical *use of nuclear energy* for peaceful purposes."[15] The Intervenors' focus on the NEA's role in encouraging maintenance and development of nuclear power signals a misunderstanding of NEA's purpose, role, and governance structure.

A clearer picture of NEA's purpose and role—which focuses not on the "development and maintenance of . . . nuclear power," as intervenors appear to contend, but upon the development and maintenance of the scientific, technical, and legal basis for ensuring that nuclear power, where it is used, is used in a safe, environmentally friendly, and economical manner—can be gleaned from the second portion of NEA's Mission Statement: "To provide authoritative assessments and to forge common understandings on key issues as input to government decisions on nuclear energy policy and to broader OECD policy analyses in areas such as energy and sustainable development."[16] The NEA is primarily a research and policy agency. Working with governmental agencies from its member countries—including the NRC[17]—NEA works in six key areas: (1) nuclear safety and regulation activities, which "assist member countries in their efforts to develop high standards of safety . . . by supporting the development of effective and efficient regulation and oversight . . . and by helping to maintain and advance the scientific and technical knowledge base;" (2) radioactive waste management activities, which "assist . . . in the development of safe, sustainable and broadly acceptable strategies for the long-term management of all types of radioactive waste;" (3) radiological protection and public health activities, which "assist member countries in the regulation and implementation and further development of the system of radiological protection by identifying and effectively addressing conceptual, scientific, policy, regulatory, operational and societal issues;" (4) nuclear science activities, which help to "identify, collate, develop and disseminate

[15] Strategic Plan at 15 (emphasis added).

[16] *Id*.

[17] NRC staff participate in NEA working groups, committees, and meetings. The NRC's strategic cooperation with NEA "complements and expands NRC's research program." http://www.nrc.gov/about-nrc/ip/intl-organizations.html. Last accessed July 14, 2014.

the basic scientific and technical knowledge required to ensure the safe, reliable and economic operation of current and next-generation" technology; (5) activities related to the development and use of nuclear energy, which focus on providing governments and other users "with authoritative, reliable information on a broad range of factors relevant to the current performance and future viability of nuclear power generation . . . for use in policy analysis and decision-making;" (6) legal affairs activities, which focus on "creat[ing] sound national and international legal regimes required for the peaceful uses of nuclear energy;" (7) data bank services, which create an "international center of reference for . . . member countries with respect to basic nuclear tools . . . used for the analysis and prediction of phenomena in the nuclear field;" and (8) information and communication activities.[18] These activities are funded by the NEA and OECD membership as a whole. No one country or company benefits from these activities. Moreover, the NEA has no regulatory authority; although it issues analyses and recommends actions for its member countries, it cannot impose requirements on its members. It is up to the government of each member country, and, in particular, its regulators, to decide whether to adopt NEA policy recommendations.

With a full understanding of the breadth and purpose of the activities at the NEA, which are all focused on information exchange and policy, it is clear to me that no reasonable individual would harbor doubts about my impartiality in the Fermi COL proceeding. The granting or denial of the Fermi COL—let alone a decision regarding a contention based on the license application—will have no impact on the NEA's financial health or even its future research or policy activities. Similarly, future activities by the NEA will only affect the Fermi COL proceeding—or other NRC licensing activities—if the NRC decides to adopt future NEA policy recommendations. Such a decision would be based on the NRC's usual regulatory procedures, including any necessary public input and interaction.

[18] Strategic Plan at 17-25.

Courts have long held that "[a]dministrative officers are presumed objective and 'capable of judging a particular controversy fairly on the basis of its own circumstances.'"[19] It has been my duty since I began my tenure at the Commission to meet my quasi-adjudicatory duties by weighing the evidence and arguments impartially and basing each decision on the adjudicatory record and applicable law. So long as I remain an administrative officer of the NRC, I fully intend to continue to discharge my duties in a fair and impartial manner.

CONCLUSION

I have considered carefully both the arguments presented in the Motion and the applicable legal standards. I find no basis for my recusal and respectfully decline to recuse myself from review of LBP-14-07 or any other matter before the Commission in this proceeding.

/RA/
William D. Magwood, IV
NRC Commissioner

Dated at Rockville, Maryland
this 14th day of July, 2014

[19] *NIRS*, 509 F3d at 572 (quoting *United States v. Morgan*, 313 U.S. 409, 421 (1941)).

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the Matter of	)	
	)	
DTE ELECTRIC COMPANY	)	Docket No. 52-033-COL
	)	
(Fermi Nuclear Power Plant, Unit 3)	)	
	)	

CERTIFICATE OF SERVICE

I hereby certify that copies of the foregoing "**Decision on the Motion of Beyond Nuclear for Recusal from Participation in Deliberations on Petition for Review of LBP-14-07"** have been served upon the following persons by Electronic Information Exchange.

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[Original signed by Brian Newell]
Office of the Secretary of the Commission

Dated at Rockville, Maryland
this 14th day of July, 2014

ATTACHMENT D

OECD Green Growth Studies

Energy

OECD

iea International Energy Agency

PRELIMINARY VERSION

Table of contents

Boxes

Figures

Tables

Chapter 2. Promoting the transition to green growth

The energy sector presents a particular challenge to achieving green growth, due to its size, complexity, path dependency and reliance on long-lived assets. Green growth policies for the energy sector can achieve important outcomes, including better resource management, innovation and productivity gains, creating new markets and industries, and reducing environmental damage.

It is possible, using existing and emerging technologies, to halve global emissions by 2050, with an additional cumulative investment of USD 46 trillion. All technology options are needed, and fundamental changes are also required by key energy users: transportation, industry and buildings.

The energy revolution that is needed can be characterised by the following elements: improved energy efficiency, widespread introduction of carbon capture and storage, increased deployment of renewable energy, nuclear energy, continued fuel switching, and support for new and enabling technologies.

Broadly, the key policies that are required to set the framework for the transformation of the energy sector include (these will vary by energy sector):

- *Provide price signals for externalities.*
- *Eliminate fossil fuel subsidies.*
- *Set frameworks to make markets work.*
- *Radically improve energy efficiency.*
- *Foster innovation and green technology policy.*

Promoting the transition to a green energy economy is not about seeking some pre-determined outcome. Rather, it is about meeting the energy needs that a growing population and development aspirations demand while strongly diverging from the environmental pressures inherent in the current energy system. Given the preponderance of fossil fuel in the current energy mix, decarbonisation plays a centrally important part of the transition. But a green energy economy is about more than climate change and greenhouse gas emissions. The scale of the challenge is certainly big enough to evoke the need for Schumpeter's idea of "creative destruction". Breaking with the path dependency of existing technologies will require new technologies and ideas that are unlikely to spring from some predetermined and incremental plan.

The pace of change could be rapid. The costs of some renewable energy technologies have declined and additional costs reductions are expected. However, there remain significant barriers to deployment from inadequate infrastructure and regulatory approaches. Wind turbines will not deliver their product if grids are feeble, and plug-in electric vehicles cannot run on the wind power if there are not sufficient places to plug them in. Technology, infrastructure, markets and enabling conditions are all critical parts of the transformation. Drastically changing energy infrastructure and equipment on a national scale is a complex undertaking. Shifting to a green growth trajectory requires particular attention to energy efficiency and to network infrastructure such as electricity grids and transport networks that enable rather than constrain economic transformation, and avoid locking-in sub-optimal and long-lived capital assets.

This chapter presents some of the benefits and potential trade-offs of a shift to a greener energy system. It then discusses the technologies and main policy options that can accelerate the transition to a green growth trajectory.

Green growth and energy: What's at stake

Greening energy will be among the earliest drivers of greener growth. Meeting growing energy demand will mean a total investment in the sector of USD 270 trillion over the next four decades (IEA, 2010a). This potentially provides an enormous opportunity to create a more sustainable base for economic and social development. Innovative ways of providing the energy services that drive economic activities and underpin well-being in a clean and sustainable way could provide new growth opportunities, creating new businesses and jobs and offsetting losses from contracting sectors.

Developing countries have opportunities to leap-frog by employing greener and more efficient technologies, business models and regulatory frameworks. Emerging economies will not become rich by following the same path as those that industrialised earlier. The environmental costs would be too high, both at the local and the global level.

Policy makers and businesses are making commitments. National targets for renewable energy are spreading. More than seventy governments around the world, including all International Energy Agency (IEA) member countries, have put in place targets and policies to support development of renewable energy technologies. In doing so, they pursue a wide variety of objectives, including improving energy security and access to modern energy services; reducing dependence on energy imports; protecting the environment; providing employment; and strengthening the competitive edge of domestic industry (Philibert, 2011).

Clean energy investments and new market opportunities

Given the depth of the world recession that ensued after the financial crisis in 2008, it is not surprising that 2009 witnessed a drop in total investment in the clean energy sector. However, Bloomberg New Energy Finance figures (2011) show that new investment ended up dropping less than

expected, partly due to soaring clean energy investment. Investments were particularly high in China. Full-year figures, based on actual transactions across all asset classes, show that new investment worldwide during 2010 totalled USD 243 billion (BNEF, 2011).

These findings highlight two things: that clean energy remains a sector with strong long-term growth fundamentals even during tough economic times; and that Asia has arrived not just as a big consumer of energy, but also as one of the regions investing the most in clean energy capacity. It is well documented that China's focus until recently was ramping up its domestic manufacturing capacity of renewable energy technologies. What changed in 2009 is the focus on building additional generation capacity in order to meet demand for power and absorb the output of China's manufacturers. The race for clean energy technology implementation by the world's nations is taking shape.

In 2010, China took first place among the G20 group of countries in clean energy investments, with total investments of USD 47.3 billion (renewable energy only). Mandatory targets for wind and solar power and the ample availability of credit have been the primary engines of China's clean energy growth. With 53 gigawatts (GW) of renewable energy in 2009, China was second in the world for installed renewable energy capacity, just behind the United States (GWEC, 2010). China also has some of the world's most ambitious renewable targets supported by fixed-rate feed-in tariff for wind, biomass and solar, calling for 2020 installation targets of 150 GW, 30 GW and 20 GW from these sources respectively. It has built a strong manufacturing base, particularly in solar, and is moving to meet growing domestic energy consumption through rapid installation of clean energy power generation capacity. China looks to become the market leader in low-carbon technologies, poised to play a key role in driving down costs to the benefit of all countries

The United States dropped to second place among the G20 countries in clean energy investments in 2009. It ended 2010 with total investments of USD 20.7 billion. Tight credit, uncertainty about tax incentives early in the year and lack of a strong national policy framework has constrained more robust investment. Also, ethanol investments that fuelled progress in the two previous years waned in 2008 and 2009. However, advanced biofuels, energy efficiency and smart grids saw investment gains. The 2009 enactment of long-term production tax credits (wind) and investment tax credits (solar) helped salvage what could have been a disappointing year. US clean energy investments were poised to climb in 2010, when much of the clean energy stimulus funding (USD 66 billion) was due to be spent. The United States continues to dominate venture finance and technology innovation, but it lags in manufacturing.

Reduce energy poverty

It is widely recognised that reliable and modern energy services are needed to facilitate the achievement of the UN Millennium Development Goals. The IEA's *WEO-2011* highlights how crucial modern energy services are to human well-being and to a country's economic development, and yet many poor households in developing countries still do not have access to them. Exposure to indoor air pollution from cooking with traditional methods creates serious health problems and greatly increases the risk of premature death. The numbers are striking: some 1.3 billion people – nearly 20% of the global population – lack access to electricity and 2.7 billion people – around 40% of the global population – rely on the traditional use of biomass for cooking (IEA, 2011a). Worse, *WEO-2011* projections suggest that the problem will persist in the longer term: in the *New Policies Scenario*, 1 billion people still lack access to electricity in 2030, more than 60% of which are in sub-Saharan Africa. In the same scenario, despite progress, population growth means that the number of people relying on the traditional use of biomass for cooking is still around 2.7 billion in 2030.

In order to provide universal modern energy access by 2030, cumulative investment of USD 1 trillion is required – an average of USD 48 billion per year, more than five-times the level of investment observed in 2009 (IEA, 2011a). Nonetheless, the total investment required is a small share of global

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investment in energy infrastructure, around 3% of the total. To arrive at this estimate, it was first necessary to assess the required technical solutions, such as the combination of on-grid, mini-grid and isolated off-grid solutions for electricity access. To identify the most suitable technology option, for providing electricity access in each region, *WEO-2011* analysis takes into account regional costs and consumer density, resulting in the key determining variable of regional cost per megawatt-hour (MWh). When delivered through an established grid, the cost per MWh is cheaper than that of mini-grids or off-grid solutions, but the cost of extending the grid to sparsely populated, remote or mountainous areas can be very high and long distance transmission systems can have high technical losses. It also estimates that achieving universal access by 2030 would increase global electricity generation by 2.5%. Demand for fossil fuels would grow by 0.8% and carbon dioxide (CO_2) emissions go up by 0.7%, both figures being trivial in relation to concerns about energy security or climate change.

Reduce air pollution – improve productivity and health

Sulphur dioxide, nitrogen oxides and particulate matter all have negative effects, both on human health and the environment. The effects of these gases are not limited to the country or region in which they are emitted, but are felt beyond national borders.

In China, the external costs of pollution – such as health costs, loss in labour productivity and loss in land productivity – amounted to 3.8% of GDP in 2005 (World Bank, 2007). Burning fossil fuels costs the United States about USD 120 billion a year in health costs, mostly because of thousands of premature deaths from air pollution (US National Research Council, 2009). This figure reflects primarily health damage from air pollution associated with electricity generation and motor vehicle transportation and does not include damage from climate change, harm to ecosystems, effects of some air pollutants such as mercury and risks to national security.

Coal accounts for about half the electricity produced in the United States. In 2005 the total annual external damages from sulphur dioxide, nitrogen oxides, and particulate matter created by burning coal were about USD 62 billion; these non-climate damages average about 3.2 US cents for every kilowatt-hour (kWh) of electricity. A relatively small number of plants, 10%, accounted for 43% of the damages (US National Research Council, 2009).

There is evidence indicating that an integrated approach addressing both air pollutants and greenhouse gas emissions, such as through energy efficiency improvements, can be considerably less costly than dealing with the issues separately (IPCC, 2007). While pursing air pollution and climate change objectives may not always be complementary, there are local air pollution benefits from pursuing clean energy policies which lower the net costs of greenhouse gas emission reductions. OECD analysis indicates that the co-benefits from climate change mitigation in terms of reduced outdoor local air pollution might cover a significant part of the cost of action, although air pollution control policies appear to be typically cheaper than indirect action via greenhouse gas emissions mitigation (Bollen *et al.*, 2009).

Potential trade-offs and adjustment costs

While the benefits and opportunities from moving towards a cleaner energy mix are considerable, the transition to a green energy system will not be without upfront costs. Careful attention will need to be paid to the associated adjustment and distributional challenges. Indeed, green growth in the context of energy generation presents particular challenges given the size, inertia and long-lived nature of many of the assets in energy systems. The entire structure of the energy economy of many countries is built around centrally supplied fossil fuel generated schemes that will take time to change.

This section reviews the range of cost estimates associated with a transition in the energy system required to tackle climate change, but does not attempt to formally assess the cost-benefit comparison. As shown in the section above, the benefits of greening the energy system go far beyond considerations of climate change. Nevertheless, from a political perspective, at least with respect to climate change, the Cancún agreement to limit global temperature rise to below 2˚C has already made this cost-benefit trade-off: the decision has been taken by the world's governments that the costs of inaction on climate change outweigh the costs of transition.

The sector with one of the highest adjustment costs in terms of additional capital investment will be in the transport sector. Of the cumulative additional investment from 2009-2035 in the IEA *450 Scenario* relative to the *New Policies Scenario,* USD 6.3 trillion, or over 40%, is needed in the transport sector. Most of this is directed towards the purchase of more efficient or alternative vehicles. The building sector is another large recipient of additional investment in the *450 Scenario*, amounting to USD 4.1 trillion. Refurbishment of buildings in OECD countries and solar phototovoltaic (PV) installations account for most of the investment. Within power generation, there is some avoided investment in electricity transmission and distribution lines, totalling about USD 930 billion. The lower level of electricity demand in the *WEO-2011 450 Scenario* – achieved through the USD 2.7 trillion investment made in buildings and industry in improving efficiency of electricity end-use – leads to a reduction in grid infrastructure investment of around USD 1.1 trillion. The increased usage of renewable energy, which requires greater investment in transmission and distribution than other energy sources, adds nearly USD 165 billion in the *450 Scenario*, partially offsetting the savings due to lower demand.

The additional capital only tells part of the story however, since it does not reflect overall return on capital or wider economic impacts. Similarly to many so-called integrated assessment models, the forthcoming OECD economy-environment modelling (OECD, 2012a *forthcoming*) provides a way of understanding how constraints on carbon emissions could impact economic growth over the course of the century. According to the OECD *Environmental Outlook to 2050*, a cost-effective 450 parts per million (ppm) pathway would lead to a reduction of GDP in 2050 of 5.5% (ENV-Linkages), but these costs rise rapidly when less cost-effective technology choices or timing of mitigation action are implemented. Recent reviews of models include Edenhofer *et al.* (2009, 2010) and the Energy Modelling Forum (Clarke *et al.*, 2009). These studies indicate that the total economic cost of limiting carbon emissions depends very strongly on the speed at which emission reductions are made, the overall level of emission reduction and thereby the overall constraint on carbon concentrations. Disregarding climate change externalities, the models estimate that limiting emissions to 650 ppm CO_2eq would result in an economic loss in the region of 0.5% of global GDP, a 550 ppm CO_2eq limit would cost between 1%-2% of global GDP, and a 450 ppm CO_2eq would cost around 2.5%-7% of global GDP.

The above values are averages across a number of different models, and the cost estimates vary widely between models depending on their structure and assumptions. Tavoni and Tol (2010) point out that the model average for the 450 ppm scenario is biased as it excludes results from models that were unable to reproduce the 450 ppm scenario (essentially finding this scenario technically infeasible). Deducing the implied average costs across a wider group of models, Tavoni and Tol estimate that the costs of a 450 ppm scenario could be as high as 8%-13% of global GDP. However, technology assumptions are critical. Tavoni and Tol show that including the possibility to capture CO_2 from biomass-fired plant (or some other backstop technology for removing CO_2 from the atmosphere) reduces the model average for 450 ppm to 2%-2.5% of global GDP.

The lower cost estimates are broadly consistent with the range identified in the Stern review, which based on a review of literature estimated adjustment costs to meet a 550 ppm CO_2eq constraint between1%-3.5% of GDP, with an average of around 1% (Stern, 2006).

These adjustment costs have to be judged not in isolation, but against the welfare gains and avoided damages from addressing climate change and other environmental externalities, as well as the other

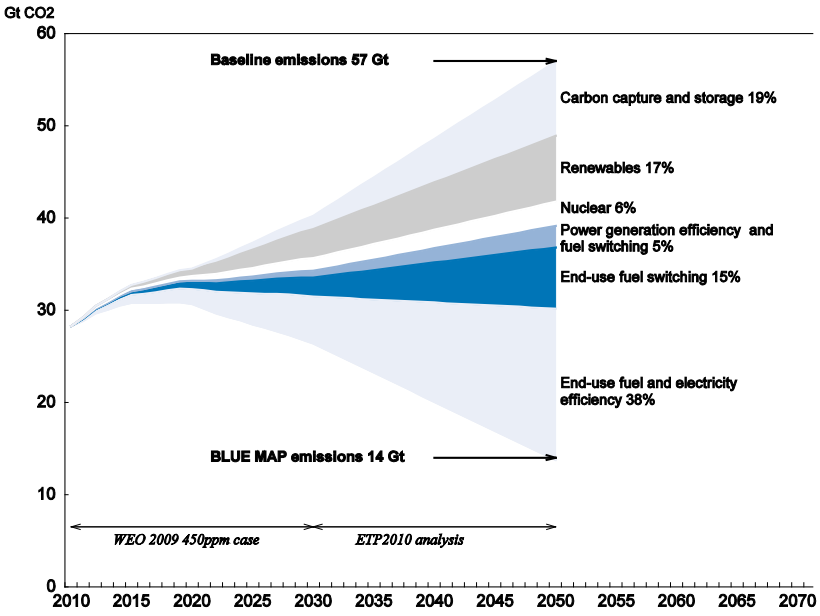
potential benefits to energy security of diversifying away from the current dependence on fossil fuels. As well as providing estimates of the overall costs of transition, these modelling studies provide three distinct policy lessons:

- *All of these studies point to the need for early co-ordinated action*. Delays tend to increase costs, because they steepen the rate of transition required in later years.
- *Constraining the types of technology that can be used in the energy sector transition substantially increases costs*. For example, the IEA's Energy Technology Perspectives (ETP) model indicates that the additional costs of electricity generation in the Blue Map scenario could be anything from 6% to 38% higher than the baseline scenario depending on the level of nuclear power and carbon capture and storage available in the mix (IEA, 2010a).
- *Involvement of as wide a group of countries as possible in the energy transition is important*. The Energy Modelling Forum integrated assessment models typically show adjustment costs around 30%-100% higher under a scenario in which there is a delayed start amongst some countries towards meeting a 550 ppm target (Clarke *et al.*, 2009).

Key technologies for green growth and energy

Moving to a sustainable energy future will require an energy technology revolution. Using a combination of existing and new technologies, it is possible to halve worldwide energy-related CO_2 emissions by 2050 with respect to current levels (Figure 2.1). Achieving this will be challenging and will require significant investment, but the benefits will also be large. It is estimated that cutting emissions from 2005 levels in half by 2050 will require USD 46 trillion of new investments in clean energy, a further increase of 17% on top of baseline investments. Between 2007 and 2009, annual investments in low-carbon energy technologies averaged approximately USD 165 billion (IEA, 2010a) with investment in 2010 at nearly USD 250 billion.

Figure 2.1. Key technologies for a low-carbon energy system in 2050



Source: IEA (2010), *Energy Technology Perspectives 2010.*

It is important to note that all technology options are needed. For instance, *WEO-2011* and the OECD *Environmental Outlook to 2050* suggest that a progressive nuclear phase-out incur additional investments to 2035 of USD 1.5 trillion, globally leading to a reduction of household real income by more than 5%. Similarly, these studies reveal that the unavailability of carbon capture and storage (CCS) technology would need to be offset by more expensive alternatives, increasing costs by at least a third. The changes cannot be restricted to electricity generation; fundamental changes are also needed in industry, transport and buildings. The key potential contributions to this energy technology revolution are described in the IEA's *Blue Map* scenario:[1]

- *Improved energy efficiency* – the biggest share of the total emissions reduction (38%) comes from an increase in energy efficiency. The annual improvement in global final energy intensity would need to increase from 1.7% to 2.6%. This requires a *doubling* of the rate of energy efficiency improvement from a business-as-usual path. These accelerated rates of end-use efficiency gains will require the immediate implementation of stronger national energy efficiency policies and measures (IEA, 2009a) to overcome market barriers. These take many forms, from inadequate access to capital, isolation from price signals, information asymmetry, and split-incentives. In the industrial sector, national policies and measures and international sectoral agreements are needed to encourage the adoption of best available technologies to deliver more efficient processes and products (IEA, 2009b). Overall, increased energy efficiency will give net financial benefits, and experience shows that it can deliver significant co-benefits, including job creation and health improvements.

- *Widespread introduction of carbon capture and storage* – the second-largest share (19%) of least-cost emissions reductions comes from the rapid and widespread introduction of CCS, both in power generation and industry. Given the long life of boilers and power generating equipment, CCS capacity will need to be retrofitted to some existing facilities to achieve the levels of penetration needed.

  To make this contribution, it is estimated that about 100 projects would be required by 2020 to support CCS deployment globally, roughly half of them in developing countries (IEA, 2009c). Continued political leadership is essential at both national and international levels to achieve the goal of broad deployment of CCS by 2020. Heightened urgency on the part of all stakeholders is needed to realise the number of projects that constitute the critical first steps in the deployment of CCS. Greater engagement of developing countries through, for example, capacity building and mapping of storage potential, will also be important steps in furthering CCS deployment.

- *Increased deployment of renewable energy* – the third-largest share (17%) is due to substantial further deployment of renewable energy technologies. By 2050, almost half of total electricity generation would need to be from renewable energy sources, up from 19% today. Wind, solar photovoltaic (PV), concentrating solar power (CSP), biomass and hydro, in particular, will all have an important role to play. For example, the scenario envisages an average annual addition of 48 GW of onshore wind for the next 40 years. Over the same period an average of 325 million square metres of PV panels would need to be installed every year. Enhanced renewable power capacity will also require increased back up capacity based on fossil fuel technologies to ensure system reliability and to address the variable nature of certain renewables.

- *Continued fuel switching* – a major part of the emissions reduction is an increase in the share of nuclear. This would require around 30 nuclear plants of 1 000 megawatts (MW) to be built each year from 2010 to 2050. Countries are currently constructing 65 nuclear reactors that are due to add 60 GW by 2015. However, the recent damage to nuclear facilities in Japan in the

wake of the earthquake and tsunami is likely to slow expansion plans, at least in the short term. The international system of safeguards on nuclear technology and materials should be maintained and strengthened where necessary. The physical protection of sites and materials must also be ensured. In addition, extensive fuel switching in industry from coal to low-carbon fuels, in particular biomass, as well as natural gas, has to be implemented. In the transport sector, sustainable biofuels, in particular advanced biofuels, together with increasing electrification of the vehicle fleet, will become increasingly important over the next decades.

A number of important cross-cutting enabling technologies will be needed to underpin these transformations. For example, to make the maximum use of energy efficiency, renewable power generation and electric vehicles, substantial investment will be needed in smart electric grids and in energy storage. Smart grids include systems to balance supply and demand, automate grid monitoring and control, flatten peak demand and communicate in real-time with consumers. Many emerging energy technologies show variability in their output (wind power, solar PV) and require a more flexible energy system (IEA, 2011b). For example, batteries and other energy storage technologies will be key enablers. Strong linkages between basic science and applied energy research are needed to maximise breakthroughs.

To help advance global development and uptake of key technologies, the IEA is developing a series of technology roadmaps. These identify priority actions for governments, industry, financial partners and civil society that are needed to realise the technology's full potential (IEA, 2010b). The roadmaps reveal a number of cross-cutting issues that need to be addressed to expedite a range of low-carbon technologies, including the need to:

- Strategically plan capital-intensive infrastructure such as smart grids and CO_2 pipeline networks on a regional basis.
- Involve local communities early in planning for large-scale demonstration and infrastructure projects for low-carbon developments to ensure that their needs are taken into consideration at the design stage.
- Increase outreach and communication on the scale of changes needed to achieve low-carbon energy outcomes and the associated costs and benefits over the next 40 years.
- Strengthen co-ordination and knowledge sharing in the international community to accelerate the transition from demonstration to commercialisation of the technologies.
- Facilitate emerging and developing economies to exploit clean energy through technology-specific capacity building and approaches tailored to their needs and opportunities.

To date, low-carbon technology roadmaps include: biofuels, carbon capture and storage, carbon capture and storage in industrial applications, cement, concentrating solar power, electric and plug-in hybrid vehicles, energy efficiency in buildings: heating and cooling systems, geothermal, nuclear power, smart grids, solar photovoltaic power and wind energy (Box 2.1).

Box 2.1. How to make a better and greener building block

Cement is the essential "glue" in concrete, a fundamental building block all around the world. Concrete is second only to water in total volumes consumed annually by society. But making cement co-produces CO_2 to the degree that the cement industry is responsible for 5% of global man-made CO_2 emissions. In developing countries, in particular, cement production is forecast to grow as modernisation and growth expands. Product substitution at a sufficient scale for real impact is not an option for at least the coming decade.

In recent years the cement industry has achieved a partial decoupling of growth and absolute CO_2 emissions: worldwide cement production grew by 54% from 2000 to 2006, whereas its absolute CO_2 emissions rose by 42%. Yet, this trend cannot continue past the point where the growth of market demand for concrete and cement outpaces the technical potential to reduce CO_2 emissions per tonne of product.

Recognising the urgency of identifying technology to reduce the carbon intensity of cement production, the World Business Council for Sustainable Development Cement Sustainability Initiative (CSI) joined with the IEA to develop a technology roadmap for cement. Since 2002, CSI member companies have collectively made significant progress on measuring, reporting and mitigating their CO_2 emissions, and sharing their progress with the rest of the cement industry. The roadmap is a logical and complementary next step. It outlines a possible transition pathway for the cement industry to reduce its direct CO_2 emissions 18% from current levels by 2050.

Source: WBCSD and IEA (2009), "Cement Technology Roadmap 2009: Carbon Emissions Reductions up to 2050".

A policy framework for greening energy

Given differing national circumstances and stages of development, there is no generic policy prescription for fostering greener energy systems. The transition will vary across regions and between countries depending upon their human and natural capital and economic conditions. However, in all cases, it should generally seek to foster growth while valuing, maintaining and restoring natural capital; promote enhanced resource and energy efficiency along the entire chain from production to end-use applications and waste disposal; move to low carbon technologies and processes and renewable energy sources; and enhance energy security and reliability.

Finding the right policy framework for growth has never been straightforward. Integrating green growth compounds the challenge. The experience of OECD countries, confirmed also by the experience of many emerging economies, suggests that while there is no single recipe for success, there are certainly some important common ingredients.

Green growth strategies need to consider a timeline spanning decades and examine how different existing and emerging technologies and new business models fit within the overall transition. At their heart they must be internalised in a government's core economic policies. Beyond that, pursuing green growth in the energy sector will require coherent and supporting policies in many other domains including agriculture, construction, industry, transport, investment, taxation, environment, science and technology and education. In addition, international co-operation will be critical, notably in setting robust and credible price signals and markets for carbon, advancing material and technology research, development and deployment, technology transfer and broadening markets for both goods and networks.

Powerful forces of competition and robust markets spur economic growth. In the environmental domain, however, markets are incomplete. To correct this, natural capital needs to be fully priced through market-based policy instruments. Putting a price on a pollution source or on the over-exploitation of a scarce resource to value the environmental externalities through mechanisms such as

taxes or trading schemes is the most efficient single policy measure. Yet, given the presence of several interacting market failures, in many cases an appropriate policy response will involve a mix of complementary instruments including regulatory policies. Infrastructure is an important element of growth and as a consequence, getting this part of the policy mix right for energy and transportation systems is crucial, and innovation in these areas will be essential (OECD, 2011a).

Furthermore, policies are required to overcome the market failures associated with green innovation. Appropriate pricing of externalities, general innovation policies, technology transfer, and the development of enabling infrastructure can go a long way in addressing these market failures. But the emergence of new technologies is a process that requires long-term investment, often initiated in public research institutions before being picked-up by firms. Hence, more specific and possibly temporary direct support for clean technologies may also be needed.[2]

The future is inherently uncertain, so a portfolio approach to policy is likely to be needed. Policy priority should be given to implement "low-hanging fruit" options that will reap financial benefits. These can help "buy time" that is needed to decrease costs of emerging technologies through initial deployment and make novel technologies available through research development, demonstration and deployment (RDD&D).

Policy packages, based on free and open markets as a fundamental point of departure, will be required to deliver results. The key areas that are applicable to most countries and sectors are explored in more detail below.

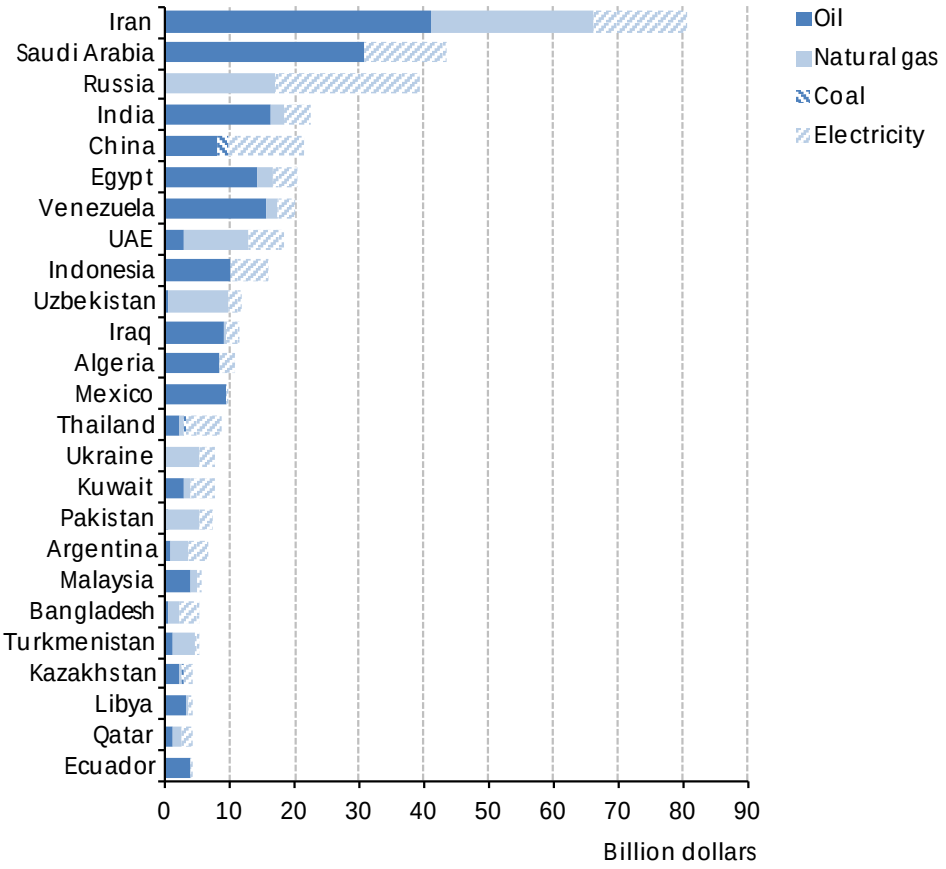
Eliminate fossil fuel subsidies

One of the most powerful tools to transition to green growth in the energy sector is to eliminate inefficient fossil fuel subsidies. These remain commonplace in many countries (Figure 2.2). They make carbon emissions cheaper, the very opposite of what any policy objective to reduce emissions calls for. Beyond that, they result in an inefficient allocation of resources and market distortions, while often failing to meet their stated objectives.

Fossil fuel consumption subsidies, as measured using the gap between domestic prices and an international reference benchmark, amounted to USD 409 billion in 2010, with subsidies to oil products representing almost half of the total (IEA, 2011a). Persistently high oil prices have made the cost of subsidies unsustainable in many countries and prompted some governments to act. The annual level can fluctuate widely with changes in international energy prices, domestic pricing policy, exchange rates and demand. These subsidies, identified by the IEA, are mainly found in developing and emerging economies. Only 8% of the USD 409 billion spent on fossil fuel subsidies in 2010 was distributed to the poorest 20% of the population, demonstrating that they are an inefficient means of assisting the poor; other direct forms of welfare support would cost much less.

Figure 2.2. Fossil fuel consumption subsidies for top 25 economies

USD Billions, 2010



Source: IEA (2011), *World Energy Outlook 2011*.

The OECD has compiled an inventory of over 250 measures that support fossil fuel production or use in 24 industrialised countries, which together account for about 95% of energy supply in OECD countries. Those measures had an overall value of about USD 45-75 billion a year between 2005 and 2010. In absolute terms, nearly half of this amount benefitted petroleum products (*i.e.* crude oil and its derivative products), with the rest equally split between coal and natural gas. Because several OECD countries do not produce significant amounts of fossil fuels, consumer measures account for a large share of overall support. Producer support remains, however, far from negligible in those OECD countries that produce fossil fuels.

A significant portion of the support provided in OECD countries is through tax expenditures such as tax credits, exemptions or reduced rates. These provisions provide a preference for fossil fuels compared with the "normal" tax rules in the particular country. Since normal tax rules and rates vary so much between countries, however, this type of support is not readily comparable. Nevertheless, the OECD inventory marks a significant step towards greater transparency and accountability with respect to those policies that relate to the production or use of fossil fuels. While it does not evaluate the merits of individual policies, the inventory is a critical first step that will facilitate analysis and understanding of which of these mechanisms may be inefficient or wasteful, and for identifying options for reform.

Phasing out fossil fuel subsidies represents a triple-win solution. It would enhance energy security, reduce emissions of air pollutants and greenhouse gases and bring immediate economic gains. IEA estimates indicate that, relative to a baseline in which rates of subsidisation remain unchanged, if fossil fuel subsidies were completely phased out by 2020, oil demand savings in 2035 would be equal to 4.4 million barrels per day (mb/d.) Moreover, global primary energy demand would be cut by about 5% and CO_2 emissions by 5.8% (2.6 gigatonnes, Gt) (IEA, 2011a). Reduced demand growth for fossil fuels would also lead to lower emissions of particulate matter and other air pollutants.

There is indeed significant scope for reducing the heavy burden that these subsidies place on government budgets, while also better targeting support to those who most need it. OECD analysis suggests that most countries or regions would record real income gains from unilaterally removing their subsidies to fossil fuel consumption, as a result of a more efficient allocation of resources across sectors. The cost of mitigation in the *450 Scenario* decreases if fossil fuel subsidies are phased out in parallel. These lower costs would occur first and foremost in the countries undertaking the subsidy reform, but also at the global level (OECD, 2012a *forthcoming*).

Considerable momentum is building to cut fossil fuel subsidies. In September 2009, G20 leaders committed to phase out and rationalise inefficient fossil fuel subsidies, a move that was closely mirrored in November 2009 by Asia-Pacific Economic Cooperation (APEC) leaders.[3] Many countries are now pursuing reforms, but steep economic, political and social hurdles will need to be overcome to realise lasting gains. The OECD and the IEA have established a joint online database to increase the availability and transparency of data on energy consumer subsidies and measures that support the production or use of fossil fuels in OECD countries.[4] This represents an essential step in building momentum for a global fossil fuel subsidy reform.

A roadmap is also provided to guide policy makers in implementing fossil fuel subsidy reform (IEA, OECD and the World Bank (2010). It draws from lessons learned from case studies in developed and developing countries. Particular attention is devoted to how to identify those subsidies that should be phased out, to address implementation challenges including policy obstacles and affordability constraints, and to facilitate the reform process through the use of targeted assistance, safety-nets and industrial restructuring packages. It considers the challenges in both consumer and producer subsidies. The roadmap may help policy makers to diagnose the key problems and the required policy response for subsidy reform.

Many countries, both within and outside of the G20 group, are moving ahead with reforms. While this is a very encouraging start, the full extent of the potential gains will only be realised if more countries raise the level of ambition and implement fossil fuel subsidy reform.

Provide price signals for externalities

Numerous OECD studies highlight that appropriate pricing of externalities is a key to enable a more level playing field, influence consumer behaviour and promote innovation. The best choice of policy instruments to address environmental externalities will vary according to the nature and size of the predominant market failure as well as to the differences in institutional capacities of the respective countries, but there are many examples of success in the energy sector. For example, market-based sulphur dioxide (SO_2) allowance trading component of the US Acid Rain Program allows utilities to adopt the most cost-effective strategy to reduce SO_2 emissions at units in their systems and has had environmentally successful results.

Economists have long recommended using economic instruments to cut pollution at least cost through mechanisms such as taxes, emissions trading systems or hybrid systems. These should ensure that no emitter pays more, at the margin, than another. Hence the environmental goal is met at least cost for society. Both types of instruments have been introduced for CO_2 emissions from fossil fuel

combustion in a number of countries and regions – CO_2 taxes since the early 1990s and emissions trading a decade or so later. Putting a price on greenhouse gas emissions through taxes and emission trading schemes introduces incentives to which investors are already reacting (Box 2.2).

Box 2.2. Lessons from the EU Emissions Trading Scheme

Launched on 1 January 2005, the European Union Emissions Trading System (EU ETS) represents the world's largest greenhouse gas emission trading system. The system now operates in 30 countries (the 27 EU Member States plus Iceland, Liechtenstein and Norway). It covers CO_2 emissions from installations such as power stations, combustion plants, oil refineries and iron and steel works, as well as factories making cement, glass, lime, bricks, ceramics, pulp, paper and board. Together with nitrous oxide emissions from certain processes, the currently covered installations account for almost half of the EU's CO_2 emissions and 40% of its total greenhouse gas emissions.

Experiences from the EU ETS show that the price signal transmitted through trading systems is effective in triggering the search for less-emitting ways of production (Ellerman and Buchner, 2008; Ellerman, Convery and de Perthuis, 2010). Even in the first years of the system, when difficulties loomed large, the price signal induced economic actors to reduce their emissions cost-effectively despite robust economic growth and other factors that could have caused emissions to increase. Abatement during the trial period has been modest, probably between 120 and 300 million tonnes of CO_2, but this is in line with the ambition of the pilot phase, which was modest. In addition, it takes time for the effects of a CO_2 price to sink in and for investments to bear fruit.

Following the introduction of the EU ETS, the price of carbon is now an economic reality in the European Union, and is taken into account in operating choices and investment decisions in the industry and electricity sectors.

A clear, predictable carbon price is likely to be an important driver of change. But it is unlikely on its own to drive short-term investments in the more costly technologies that have long-term environmental and economic benefits. While regional and some unilateral national initiatives on pricing are emerging and there is significant and positive experience with the EU ETS, a truly global carbon market looks unlikely to emerge in the near future. Many energy-efficient and some low-carbon energy supply technologies are available today at zero or low additional net cost. But a number of other technologies will not enter the market in a substantial way until prices are between USD 25 and 75 per tonne of CO_2 (IEA, 2010a). This is much higher than the CO_2 prices seen today (European Climate Exchange, 2011). Therefore to avoid locking in inefficient, carbon-intensive technologies during the next decade, governments will need to intervene with targeted policies to bring down the cost of low-carbon alternatives and to create markets for technologies that are not yet fully commercial in the context of their green growth strategies.

Set enabling conditions to support market functioning

Green growth strategies need to set the basic enabling conditions to allow markets to deliver the desired outcomes as well as additional measures in areas where market signals are not fully effective. Of course, the mix of policy tools, and how and when they are used, depends on national circumstances. Much research has examined the breadth and effectiveness of a multitude of policies and measures and different regulatory models that are used to address economic development and environmental protection with a view to achieving sustainable development.

Governments are responsible for creating the domestic conditions for private investment to flourish, through macroeconomic stability, good public governance, equitable and efficient tax systems, improved

infrastructure and sound financial markets. Governments also set the frameworks for the protection of property rights and the promotion of good corporate governance, competition and open trade policies. Policy makers involved in green growth strategies should focus on enabling conditions including:

- Establishing sound regulatory frameworks over the long term that remove barriers to green investments; regulating environmentally harmful practices through standards or command and control regulations; and aligning regulatory regimes to foster green economic activity. This will include integration of clear environmental goals into investment policies through a mix of policies and instruments ranging from carbon pricing, research and development (R&D), financial, and regulatory policies to "soft" measures such as education and information (OECD 2012b, forthcoming).
- Directing public spending to priority uses such as procurement methods that help build markets for green products and services, and to infrastructure that enables the large-scale transformations needed in energy and transportation systems. Another priority use may be transitional support for immature technologies that is performance based and time-bound (*i.e.* with sunset clauses) (Kalamova, Kaminker and Johnstone, 2011).
- Investing in education, training and capacity building. Enabling actions to foster wider industry and public support for low-carbon energy systems include: fostering industry leadership; developing a skilled low-carbon energy workforce; deepening public engagement and strengthening international collaboration.
- Strengthening international governance in areas that regulate economic activity, *e.g.* trade and investment laws and multilateral environment agreements.

While public investment is needed to catalyse the transition to a green economy, it will be the private sector that will ultimately provide most of the investment. The transition offers significant new opportunities for business, as a large range of green technologies will need to be developed and deployed widely over the next few decades. Capital is limited and returns must be sufficient to warrant their associated risks. Investment in new energy technologies and systems will require higher returns than investments in traditional ones. Institutional investors, who hold the largest share of private-sector funding, are risk adverse and will require predictable income streams in order to invest. Governments need to pay close attention to the investment environment to ensure that there are framework conditions that will attract the necessary funding. Policy predictability is important to enable investors to evaluate the risk of policy changes on potential investments.

Radically improve energy efficiency

Policies to enhance energy efficiency offer a powerful and cost-effective tool to contribute to green growth strategies (Box 2.3.). Efficiency improvements can reduce the need for investment in energy infrastructure, cut fuel costs, increase competitiveness, lessen exposure to fuel price volatility, increase energy affordability for low income households, cut local and global pollutants and improve consumer welfare. Efficiency gains can also boost energy security by decreasing reliance on imported fossil fuels. And results can be delivered soon. Allocating resources to energy efficiency can achieve many policy objectives at the same time.

Further decoupling of energy use and economic growth demands efficiency gains along the whole energy system from production to transformation, distribution and end-use applications. Energy efficiency offers the biggest scope for better environmental performance and can also be a boost to green growth in employment and economic efficiency. Energy-efficiency investments in buildings, industry and transport usually have short pay-back periods and negative abatement costs, as the fuel-cost savings over the lifetime of the capital stock often outweigh the additional capital cost of the efficiency measure.

Energy efficiency measures are often most cost-effective when new plants or buildings are being designed and built.

Box 2.3. Sample of recent national energy efficiency programme investments

Canada: The Government of Canada is investing CAD 400 million to renew the ecoENERGY Retrofit – Homes programme.

Chile: Economic incentives introduced recently include the creation of a tax exemption for installation of solar thermal systems; the implementation of a truck replacement programme (in 2009, the amount of the programme was USD 3.8 million) and the creation of a tax incentive for the purchase of hybrid vehicles in 2008. A National Agency of Energy Efficiency was established in May 2010.

France: Economic stimulus measures provide incentives for scrapping old vehicles and launch a zero-interest loan programme for residential energy efficiency improvements. They also included energy requirements for new buildings (50 kWh/m^2/year) and energy efficiency assessment and renovation of state-owned buildings.

Korea: Stimulus package funds of USD 6 billion are to promote green homes, light-emitting diode(LED) lighting in public facilities and efficiency in schools. USD 1.8 billion was allocated to support the development of fuel-efficient vehicles.

Spain: The new National Energy Efficiency Action Plan's goal is to reduce final energy consumption per unit of output by 2% annually between 2011 and 2020, or 133 000 kilotonnes of oil equivalent (ktoe) (965 million barrels) of primary energy in this period. Its implementation is expected to mobilise investment worth EUR 45.985 million.

United Kingdom: Funds were accelerated for investment in the Warm Front, which provides insulation and heating measures to vulnerable households.

Sources: IEA (2009), *Implementing Energy Efficiency Policies: Are IEA Member Countries on Track?*

All countries state that significantly improving energy efficiency is a priority. To support the adoption of energy efficiency policy measures, a consolidated set of policy recommendations have been recently updated that cover 25 fields of action across seven priority areas: buildings, industry, power utilities, appliances, lighting, transport and cross-sectoral activities (Table 2.1) (IEA, 2011c). All recommendations were subject to a rigorous set of criteria and have been endorsed by IEA energy ministers in 2011. If implemented globally without delay, these policy actions could reduce global CO_2 emissions by 7.6 Gt per year by 2030 – equivalent to one and a half times the current CO_2 emissions in the United States. In 2010, this corresponded to energy savings of more than 82 exajoules (EJ)/year by 2030, or 17% of the current annual worldwide energy consumption.

Table 2.1. IEA's 25 energy efficiency recommendations

Across sectors	1. Energy efficiency data collection and indicators 2. Strategies and action plans 3. Competitive energy markets, with appropriate regulation 4. Private investment in energy efficiency 5. Monitoring, enforcement and evaluation of policies and measures
Buildings	6. Mandatory building codes and minimum energy performance requirements 7. Aiming for net zero energy consumption buildings 8. Improving energy efficiency of existing buildings 9. Building energy labels and certificates 10. Energy performance of building components and systems
Appliances and equipment	11. Mandatory energy performance standards and labels for appliances and equipment 12. Test standards and measurement protocols for appliances and equipment 13. Market transformation policies for appliances and equipment
Lighting	14. Phase-out of inefficient lighting products and systems 15. Energy-efficient lighting systems
Transport	16. Mandatory vehicle fuel-efficiency standards 17. Measures to improve vehicle fuel efficiency 18. Fuel-efficient non-engine components 19. Improving operational efficiency through eco-driving and other measures 20. Improve transport system efficiency
Industry	21. Energy management in industry 22. High-efficiency industrial equipment and systems 23. Energy efficiency services for small and medium-sized enterprises 24. Complementary policies to support industrial energy efficiency
Energy utilities	25. Energy utilities and end-use energy efficiency

Source: IEA (2011), *25 Energy Efficiency Policy Recommendations*.

Governments need to employ a cohesive suite of measures because the barriers to energy efficiency are pervasive, dispersed and complex. Energy efficiency improvement is often hampered by market, financial, informational, institutional and technical barriers. These barriers exist in all countries, and energy efficiency policies are aimed at overcoming them. The major barriers are summarised in Table 2.2.

Table 2.2. Typical barriers to energy efficiency

Barrier	Example
Market	• Market organisation and price distortions prevent customers from appraising the true value of energy efficiency. • Split incentive problems created when investors cannot capture the benefits of improved efficiency. • Transaction costs (project development costs are high relative to energy savings).
Financial	• Up-front costs and dispersed benefits discourage investors. • Perception of efficiency investments as complicated and risky, with high transaction costs. • Lack of awareness of financial benefits on the part of financial institutions.
Information and Awareness	• Lack of sufficient information and understanding, on the part of consumers, to make rational consumption and investment decisions. • Incomplete information if technology has a lack of track record.
Regulatory and Institutional	• Energy tariffs that discourage efficiency investment, such as declining block rates. • Incentive structures encourage energy providers to sell energy rather than invest in cost-effective energy efficiency. • Institutional bias towards supply-side investments.
Technical	• Lack of affordable energy efficiency technologies suitable to local conditions. • Insufficient capacity to identify, develop, implement and maintain energy efficiency investments.

A recent assessment of progress with implementing the 25 recommended energy efficiency policies and measures found that although there is substantial energy efficiency policy action, there is still considerable scope for scaling-up efforts (IEA, 2011d).

Across all countries, policies for transport stand out as needing the most additional attention. About 60% of world oil is consumed in the transport sector. To achieve significant savings in this sector, complete package of policy measures is recommended including the introduction of mandatory fuel efficiency standards for cars and heavy-duty vehicles, complementary measures such as labelling and incentives, and improving overall transport system efficiency through modal shift and urban planning.

Progress is also needed in the buildings sector. Buildings account for 40% of energy use in most countries. Buildings offer one of the most cost-effective sectors for reducing energy consumption, with estimated savings of 1 509 million tonnes of oil equivalent by 2050, about the combined level of primary energy supply in Russia, Japan and Germany. Governments need to strengthen the energy efficiency requirements of building codes and standards, promote the adoption of low-energy houses and improve the monitoring of energy efficiency performance in existing structures.

Many governments are seeking assistance with how to implement the 25 energy efficiency recommendations in a way that suits their national context. A lack of experience or insufficient knowledge of how to deal with issues such as planning a strategy for implementation, stakeholder consultation, allocation of resources in the right time sequence, providing training and education, and communication of results can stand in the way of countries effectively implementing the recommendations. The IEA publishes the Policy Pathway series which provides guidance on the milestones in the steps to implementing individual energy efficiency policies.

A policy pathway on energy performance certification of buildings provides a "how to guide" to policy makers and relevant stakeholders on the essential elements to implement an energy performance certification of buildings programme (IEA, 2010c). Energy performance certification of buildings is a way to rate the energy efficiency of individual buildings – whether they be residential, commercial or public.

Performance certification is a key policy instrument that can assist governments in reducing energy consumption in buildings. The guide showcases experiences from countries around the world to show examples of good practice and delivers a policy pathway of ten critical steps to implement building energy performance certification programmes.

More than 50 countries worldwide implement end-use equipment programmes to improve energy efficiency. They cover energy efficiency schemes for end-use electrical appliances and equipment in the residential, commercial and industrial sectors. Another policy pathway gives clear guidance to policy makers and relevant stakeholders on best practice compliance, through monitoring, verification and enforcement (MVE), in end-use appliance and equipment standards and labelling programmes. Improving the design and implementation of MVE schemes can curtail the high levels of non-compliance that have hampered the effectiveness of some programmes in the past (IEA, 2010d).

The right technology and market mechanisms are crucial to achieve greater energy efficiency. But so are legal, institutional and co-ordination structures to promote the efforts. Drawing on the experience of hundreds of energy efficiency experts around the world, a handbook on energy efficiency governance provides useful guidance for government officials and energy efficiency practitioners on establishing effective structures to support national and sub-national efficiency policy implementation (IEA, 2010e).

Foster innovation and green technology policy

Innovation is a key driver in the transition to a green economy. It will be very difficult and very costly to address global environmental dilemmas such as climate change without successful innovation. Putting a price on pollution through measures such as environmentally-related taxes and tradable permits is a necessary condition for encouraging 'green' innovation (OECD, 2010a). However, this is unlikely to be sufficient, and the broader policy framework must complement targeted environmental policies.

One of the essential lessons in the OECD Innovation Strategy is that countries that harness innovation and entrepreneurship as engines for new sources of growth will be more likely to pull out of and stay out of recession (OECD, 2011a). Governments can help by creating the environment and safeguarding the drivers of innovation. Developing new sources of growth will depend on investing in innovation and skills. Policy makers have to take a lead, by tapping new sources of growth themselves, and setting the regulatory framework to allow breakthroughs to happen and to overcome inertia, whether institutional or economic, that prevent them.

Innovation is likely to be coupled with a process of creative destruction to bring new ideas and new business and institutional models to enable green growth. Such changes may include: the redesign of electricity delivery mechanisms to improve efficiency by cutting line losses, which amount to about 9% of global electricity production; accommodating low-carbon variable and decentralised supply sources; facilitating active network control and flatten peak demand curves to make better use of capital-intensive assets; and engaging consumers in demand-side management through price signals. This requires policies to promote innovation in technologies such as high-voltage direct current lines, information and communication technology (ICT) platforms and smart meters to name a few, but also new market and regulatory models.

The standardisation of technical specifications for converging technologies is necessary to foster green innovation (OECD, 2011a). As some business models for green innovation are still emerging,

government engagement in the standardisation process can catalyse involvement of relevant stakeholders. Developing a common set of well-designed specifications, such as the inter-operability of smart grids and connections between electric vehicles and the charging stations, could contribute to developing the market, stimulating private investment and avoiding the emergence of incompatible technical elements. For example, the National Institute of Standards and Technology (NIST), an agency of the US Commerce Department, co-ordinates a Smart Grid Inter-operability Standards Project with the aim of identifying and developing standards critical to achieving a reliable and robust smart grid. NIST is conducting the project in three phases: identifying the gaps in available standards and priorities for revising existing or developing new standards; establishing a formal private-public partnership to drive long-term progress; and developing and implementing a framework for testing and certification.

Government policies need to ensure competitive selection processes, focus on projects that best serve public policy objectives, avoid favouring incumbents, ensure a rigorous evaluation of policy impacts and contain costs. Proven approaches include multiyear appropriations, independence of the agencies making funding decisions, use of peer review and other competitive procedures with clear criteria for project selection, and payments based on progress and outcomes rather than cost recovery (OECD, 2011a). Government support policies also need to be aligned with existing international commitments, notably under the World Trade Organization (WTO).

A range of OECD work underscores that innovation is core to moving onto a green growth path. For example, it looks at eco-innovation in industry (OECD, 2010b); greener and smarter information and communication technology (OECD, 2010c); and transition to a low-carbon economy (OECD, 2010d). Another demonstrates that green technology development is accelerating notably in air pollution control and renewable energy as measured by the number of patents (OECD, 2010e). Some conclusions arising from *Fostering Innovation for Green Growth* have particular relevance for the energy dimensions of green growth, as summarised below:

- Public investment in research is needed to help lower the costs of green innovation, to expand the scope for technological breakthroughs and to create new opportunities.
- Governments need to encourage the process of experimentation to bring about favourable options at the lowest cost. This involves a vigorous process of national and global competition among alternative technologies and innovations, to bring about those that have the best performance.
- Where solely private efforts are unlikely to be sufficient to commercialise technologies, government action, including public support, may be required to overcome market failures and barriers, such as dominance by existing business models and technologies. The primary market failure is the risks and time frames before profits are realizable can be too great for industry without government support. However, such policies should be well-designed to avoid capture by vested interests and regularly evaluated to ensure that they are effective and efficient in meeting public policy objectives.
- Countries may want to prioritise their efforts in areas where they have capabilities and a certain critical mass and focus on green technologies and innovations that are particularly relevant in the national context. In other areas, international collaboration provides a means to gain access to relevant research and work together for solutions to global issues (Box 2.4). At the same time, international competition will be essential to drive down the costs of green innovation and benefit from the global process of experimentation.

Box 2.4. The Low Carbon Energy Technology Platform

Created in response to a request from the G8 Summit in l'Aquila, Italy, and IEA Ministers, the International Low-Carbon Energy Technology Platform seeks to encourage, accelerate and scale-up action for the development, deployment and dissemination of low-carbon energy technologies. It does this by focusing on practical activities at international, national and regional levels to:

- Bring together stakeholders to catalyse partnerships and activities that enhance the development and implementation of low-carbon energy technology strategies and technology roadmaps at regional and national levels
- Share experience on best-practice technologies and policies and build expertise and capacity, facilitating technology transition planning that fosters more efficient and effective technology dissemination
- Review progress on low-carbon technology deployment to help identify key gaps in low-carbon energy policy and international co-operation, and support efforts to address these through relevant international and regional fora

The Technology Platform is not a formal body or institution, but an informal forum that initiates activities and shares policy-related information among stakeholders interested and willing to help accelerate the spread of low-carbon energy technologies. The Technology Platform seeks to enhance collaboration among governments, business, the financial sector, expert bodies, international organisations and civil society. The focus is on practical action and the creation of networks through a wide range of activities that fall into one of four broad categories :

- Country-led collaborations
- Technology deployment through roadmap and strategy development
- Linking to other international collaborative efforts
- Technology deployment status, policy review, RD&D analysis

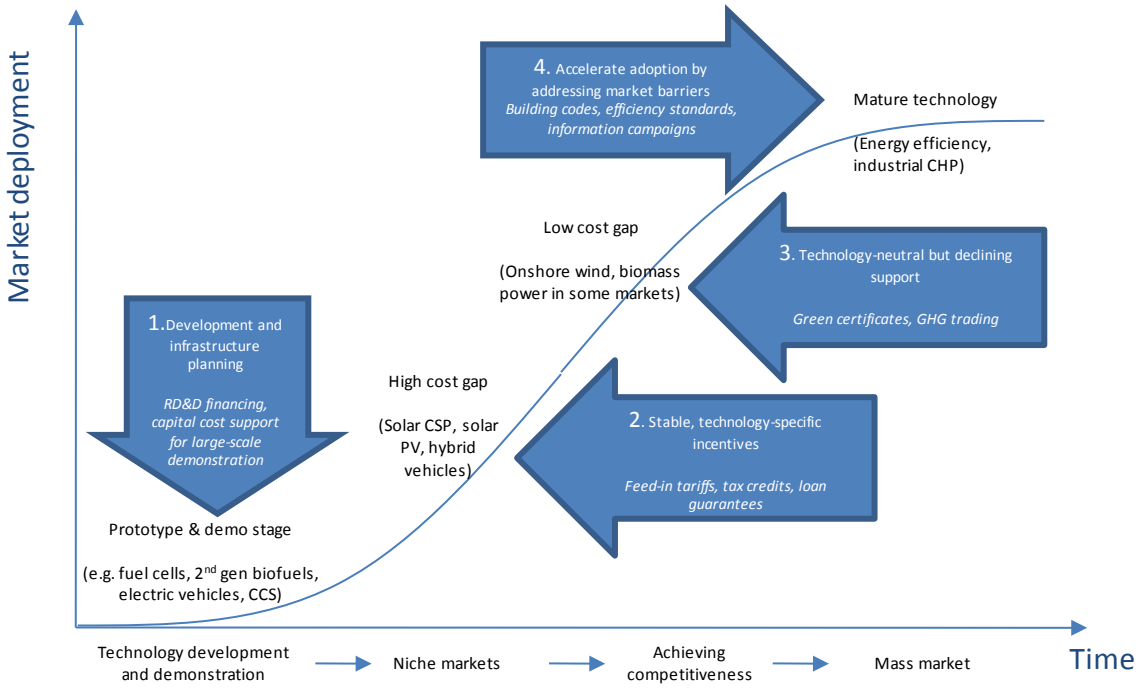
A concerted global effort to foster green innovations will significantly enhance the portfolio of options available. Many of the most promising low-carbon energy technologies currently have higher costs than the fossil fuel incumbents. Most new technologies will require, at some stage, both the "push" of research, development and demonstration (RD&D) and the "pull" of market deployment. As shown in Figure 2.3, in order to target the cost competitiveness gap, a range of policy measures will be required (IEA, 2010a):

- For promising but not yet mature technologies (Stage 1), governments need to provide financial support for additional research and/or large-scale demonstration and to start to assess infrastructure and regulatory needs.
- For technologies that are technically proven, but require additional financial support (Stage 2), governments need to provide support with capital costs, or to introduce technology-specific incentives such as feed-in tariffs, tax credits and loan guarantees, and appropriate regulatory frameworks and standards, to create a market for the relevant technologies.
- For technologies that are close to competitive (Stage 3), governments need to move towards technology-neutral incentives that can be progressively removed as technologies achieve market competitiveness.

- For technologies that are competitive (Stage 4), governments can best help scale up public and private investment by tackling market, informational and other barriers and by developing effective intervention policies and measures.
- Many technologies in practice straddle two or more stages of development. Government intervention needs to be tailored accordingly, in some cases providing support to all four phases of technology development simultaneously.

The overriding objectives should be to reduce risk, stimulate deployment and bring down costs. Evidence suggests that a large proportion of breakthrough innovations come from new firms that challenge existing business models. Thus, government steps to remove barriers to the entry and growth of new firms have an important part to play in low carbon energy technology development.

Figure 2.3. Policies for supporting low-carbon energy technologies



Note: The figure includes generalised technology classifications; in most cases, technologies will fall into more than one category.

Source: IEA (2010), *Energy Technology Perspectives 2010.*

Governance of intellectual property (IP) has an important influence on the marketability of new technologies. Private ownership of IP arising from government-funded R&D is a powerful tool for marketing research results. Experience from the United States indicates that governments should take steps to ensure that IP from public research is efficiently transferred to the private sector. The Bayh-Dole Act (1980) has made technology transfer a formal responsibility of government laboratories and has attributed the ownership of IP to the researcher, even when a project is funded by the government. Although initially restricted to universities and small business, coverage has since been progressively expanded. These policy changes spurred private entities and government to seek RD&D partnerships. Popp (2006) examined citations referring to patents in 11 categories of energy technology, and found that after the technology transfer acts came into force in the early 1980s, privately held patents that cited

government patents became the most frequently cited, suggesting a fruitful transfer of government research results to private industry (IEA, 2011e).

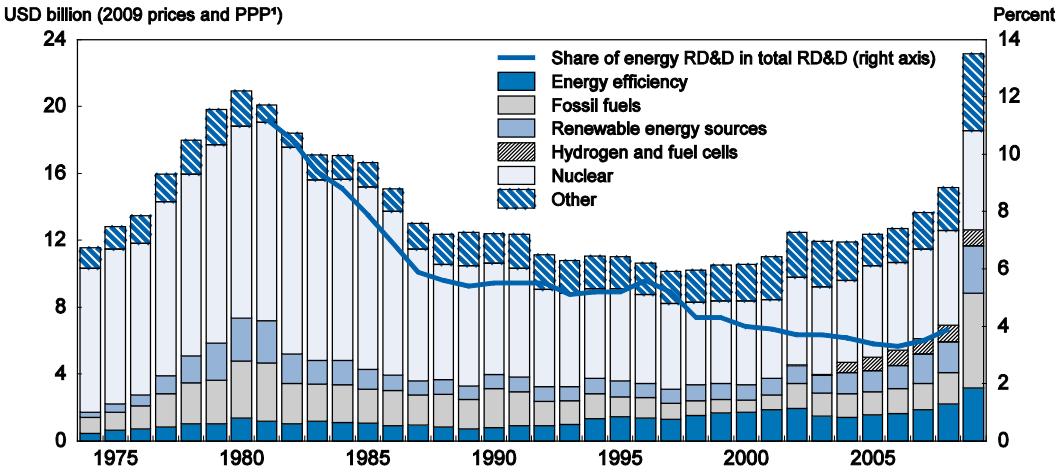
Energy RD&D expenditures

To achieve a 50% CO_2 emissions reduction objective, government funding for RD&D in low-carbon technologies will need to be two to five times higher than current levels (IEA, 2010a). This message is being taken seriously by many countries. Governments of both the Major Economies Forum and the IEA have agreed to dramatically increase and co-ordinate public-sector investments in low-carbon RD&D, with a view to doubling such investments by 2015. Simply increasing funding will not, however, be sufficient to deliver the necessary low-carbon technologies. Current government RD&D programmes and policies need to be improved by adopting best practices in design and implementation. This includes the design of strategic programmes to fit national policy priorities and resource availability; the rigorous evaluation of results and adjusting support if needed; and the increase of linkages between government and industry, and between the basic science and applied energy research communities to accelerate innovation.

More investment in low-carbon energy technology RD&D is needed at all stages of technology development. This should include direct government funding, grants and private-sector investment. After years of stagnation, government spending on low-carbon energy technologies has risen. But current levels still fall well short of what is needed to deliver green growth objectives. Data for private-sector spending are very uncertain.

Figure 2.4. Government RD&D expenditures in IEA member countries

1974-2008



1. PPP= Purchasing Power Parities. RD&D budgets for the Czech Republic, Poland and Slovak Republic have not been included for lack of availability.

Source: IEA databases, 2010 cycle.

Government energy RD&D budgets in IEA member countries declined between the early 1980s and the 1990s from USD 9 billion in 1980 to USD 8 billion in 1997 (Figure 2.4). The decline was associated with the difficulties of the nuclear industry and with the decrease in oil prices from 1985 to 2002. Since 1998, government expenditures on energy RD&D have started to recover, particularly between 2005 and

2008. Expenditure in 2008 was about USD 12 billion. The share of energy RD&D in total RD&D declined from 11% in 1985 to about 3% in 2006 but appears to be rising again.

Policies for green growth in specific energy sectors

This section looks at technology policy for three key components of a green growth strategy for energy – electricity, renewables and transport.

Electricity sector

In most OECD countries, a new investment cycle in power generation is looming. A window of opportunity now exists to establish policies that will deliver a cleaner and more efficient generation portfolio that will have significant impact on the energy sector and the environment for the next 40-50 years. However, the many uncertainties now inherent in the power sector create risks for investors, risks that may lead to under-investment – too little, too late, in the wrong location and with the wrong technology.

The ageing of existing units, and eventual need for replacement, is inevitable. Most OECD countries experienced an investment boom in the 1970s, in response to the oil price crisis. Many countries shifted generation portfolios away from oil, to coal and nuclear. Many these units are now approaching the end of their technical lifetime. However, investments in refurbishment and upgrades can extend the lifetime and capacity of units. Delaying the replacement process can be commercially attractive especially when faced with uncertainty over the pace of change in environmental regulation. Policies need to be robust enough to achieve closure of the dirtiest and least efficient plants at the earliest opportunity.

The liberalisation of electricity markets delivers considerable benefits if well designed and implemented and if backed by ongoing government commitment. In fact, competitive markets with cost-reflective prices are a strong instrument to effectively balance energy systems in terms of economic efficiency, reliability and environmental performance. Restructuring in power markets is one of the uncertainties for investors, but the risks can be greatly reduced when competitive and liquid markets are allowed to develop. Other uncertainties for investment include ambiguity about future CO_2 constraints and associated pricing of carbon power plant licensing, issues around nuclear power acceptability, local opposition to new energy infrastructure and government support for specific generation technologies. Government action is needed to significantly reduce policy uncertainty. This would serve to establish effective competitive markets and provide firm policy directions in those areas in which markets fall short, such as taking account of environmental costs. Governments must also clarify and simplify power plant licensing procedures to accelerate the approval of new generation units (IEA, 2007a).

One of the most difficult decisions for investors is the choice of technology, which obviously has implications for the environment and security of supply. Moreover, a well-diversified generation portfolio designed to deliver supply efficiently both now and in the future, will have to include several technologies. Thus, the choice for investors depends on many factors and is always made with an eye on the potential for profit. Small changes in the key cost factors, *e.g.* investment costs, fuel costs, CO_2 emission costs and utilisation rates, can significantly change the relative ranking of technologies in terms of total generation costs levelised over the lifetime of the plant. Well-functioning markets for electricity, fuel and CO_2 emissions provide strong incentives for investors to diversify and to opt for clean technologies although diversification is, obviously, limited to the technology options actually available. Government policies play a critical role in keeping as many options open as possible by supporting R&DD of new technologies and through effective policies and regulation, including those that govern market competition, network access and rates.

Good market design, effective regulation, competition and clear, long-term environmental policy are critical factors for well-functioning electricity markets. The danger of a concentrated market is that firms with market power may withhold new investment as a means to push up prices and increase profits – outcomes that are ultimately detrimental to public welfare. Such a strategy can succeed for extended periods only if dominant firms can, at the same time, block or obstruct investments by competing firms. Thus, it is important to create the right conditions to encourage competing firms to enter markets, including rules and market design that are clear, efficient, and ensure equal treatment for all players. To this end, independent regulators and independent transmission system operators play critical roles in establishing trading rules and ensuring fair access to networks. These roles must be effectively separated from generation and retail supply.

Trade and co-operation across jurisdictional borders are also important benefits of liberalisation. Resources can be used more efficiently, which allows co-operating systems to function reliably with lower reserve margins. Trade can be particularly valuable for intermittent renewables to foster increased market penetration by smoothing supply variability. Cross-border trade is constrained by available transmission capacity, but with an appropriate market design the benefits also create incentives for investment in new transmission interconnections. The benefits are even more significant for smaller systems; indeed for smaller markets, cross-border trade may be the only way to improve competition among local generators.

Sectoral Approaches in Electricity: Building Bridges to a Safe Climate shows how the international climate policy framework could effectively support a transition towards low-CO_2 electricity systems in emerging economies, without waiting for countries to take on national commitments. These include sector-specific objectives for developing countries; new market mechanisms based on sectoral crediting or caps; and international support for sharing best technology and best practice in priority sectors such as electricity (IEA, 2009d).

Governments are best positioned to assess, on a broad scale, the environmental risks and costs associated with power generation, and possible macro-economic implications resulting from too high dependence on, for example, natural gas imports. That said, governments are not necessarily best equipped to actually manage risks by picking preferred technologies and generation portfolios. Many clean and non-import dependent technologies, including some renewable technologies, carbon capture and storage and nuclear power, need government support that reflects the added benefits for the environment and from reduced import dependence. Commercial investors have a long history of managing risk in the marketplace and are best placed to assess the optimal choice and combination of technologies, taking into account technology maturity and efficiency concerns. Governments and commercial investors are complementary. The principal role of government is, through market-based instruments, to create incentives for investment decisions that support policy objectives on environment, energy security and economic growth. Market-based instruments are already available for several environmental policy objectives; they have shown the potential to improve cost effectiveness and are compatible with liberalised electricity markets (IEA, 2007a).

Box 2.5. Policy action for smart grids

The world's electricity systems face a number of challenges, including ageing infrastructure, continued growth in demand, the integration of increasing numbers of variable renewable energy sources and electric vehicles, the need to improve the security of supply and the need to lower carbon emissions. Smart grid technologies offer ways not just to meet these challenges but also to develop a cleaner energy supply that is more energy-efficient, more affordable and more sustainable.

These challenges must also be addressed with regard to each region's unique technical, financial and commercial regulatory environment. Given the highly regulated nature of the electricity system, proponents of smart grids must ensure that they engage with all electricity system stakeholders, including equipment manufacturers, system operators, consumer advocates and consumers, to develop tailored technical, financial and regulatory solutions that enable the potential of smart grids.

Large-scale pilot projects are urgently needed in all world regions to test various business models and then adapt them to the local circumstances. Countries and regions will use smart grids for different purposes; emerging economies may leapfrog directly to smart electricity infrastructure, while OECD countries are already investing in incremental improvements to existing grids and small-scale pilot projects.

Current regulatory and market systems can hinder demonstration and deployment of smart grids. Regulatory and market models – such as those addressing system investment, prices and customer participation – must evolve as technologies offer new options over the course of long-term, incremental smart grid deployment.

Greater international collaboration is needed to share experiences with pilot programmes, to leverage national investments in technology development, and to develop common smart grid technology standards that optimise and accelerate technology development and deployment while reducing costs for all stakeholders.

A number of countries are already taking steps. For example, Korea announced its National Smart Grid Roadmap in January 2010, and has invested USD 230 million to establish a smart grid test-bed in the Jeju Island. Korea plans to increase investment in spreading smart grid technologies after developing new business models through the test-bed. Moreover, the Act on Facilitating the Smart Grid was approved by the National Assembly of Korea in April 2011, which will serve as a stable foundation for increasing the investment on the successful development and spread of the smart grid technologies. In 2011 the Italian regulator (Autorità per l'Energia Elettrica ed il Gas) has awarded eight tariff-funded projects on active medium voltage distribution systems, to demonstrate at-scale advanced network management and automation solutions necessary to integrate distributed generation. The Ministry of Economic Development has granted over EUR 50 million in the past 5 years for smart grid R&D activities through the Energy System Research Fund and over EUR 200 million for demonstration of smart grids features and network modernisation in Southern Italian regions.

Renewable energy

Renewable energy sources play a central role in moving the world onto a more secure and sustainable energy path. The potential is unquestionably large, but how much and how quickly their contribution to meeting the world's energy needs grows hinges critically on the strength of government policies to stimulate technological advances and make renewables cost competitive. The IEA's definition of renewable energy sources includes energy generated from solar, wind, biomass, the renewable fraction of municipal waste, geothermal sources, hydropower, ocean, tidal and wave resources, and biofuels (IEA, 2007b).

The greatest scope for increasing the use of renewables in absolute terms lies in the power sector. Renewables are generally more capital intensive than fossil fuels, so the investment needed to provide the renewables capacity is very large. Investment in renewables to produce electricity is estimated at

USD 5.7 trillion (in year-2009 dollars) over the period 2010-2035. Investment needs are greatest in China, which has now emerged as a leader in wind power and photovoltaic production, as well as a major supplier of the equipment. The Middle East and North Africa region holds enormous potential for large-scale development of solar power, but there are many market, technical and political challenges that need to be overcome.

Only a limited set of countries has implemented effective support policies for renewable energy technologies that have accelerated renewables deployment in recent years (IEA, 2008). The "OECD-EU" countries, which generally have a longer history of renewable energy support policies, show the highest policy effectiveness for "new" renewables for power generation. With more mature renewable electricity technologies such as hydro and in the heat and transport sectors, the picture is more varied with some non-EU-OECD and BRICS countries also having implemented relatively effective policies.

Non-economic barriers have significantly hampered the effectiveness of renewable support policies and driven up costs in many countries, irrespective of the type of incentive measure. Examples include administrative hurdles in land-use planning and siting, long lead times for permits, lack of co-ordination between relevant authorities; grid access; lack of technical capacity and training and social acceptance (IEA, 2008).

Overall the effectiveness and efficiency of renewable energy policy are determined by the consistency of measures and adherence to these key policy design principles:

- Effective implementation of transitional incentives, which are based on the maturity of the technology and decrease over time, to promote innovation and move technologies to market competitiveness.
- Need for a predictable and transparent support framework to attract investments.
- Adequately address non-economic barriers and social acceptance issues to stimulate market development.
- Take due consideration of the impact of large-scale penetration of renewable energy technologies on the overall energy system, particularly in liberalised energy markets with regard to overall cost efficiency and system reliability.

Transportation sector

Transport is a critical and difficult sector in the transition to green growth. Transport accounts for about 19% of global energy use and almost one-quarter of energy-related CO_2 emissions. With current trends these factors increase by more than 80% by 2050. Cars and trucks are the biggest contributors, but aviation and shipping are also growing rapidly.

Substantially greening the transport sector will require policies to promote both the widespread adoption of best available technology, and the longer-term development and deployment of a range of new technologies. It will also require strong policies to ensure the rapid uptake of these innovations and to encourage sensible changes in travel patterns (IEA, 2009e).

Fuel efficiency standards

The first priority should be policies for fuel efficiency improvements that employ technologies and practices that are already cost-effective. A 50% reduction in fuel use per kilometre for average new light-duty vehicles around the world, from incremental technology improvements and hybridisation, is possible by 2030 and is likely to be cost effective even at relatively low oil prices. Policies are needed both to ensure maximum uptake of efficiency technologies and to translate their benefits into fuel

economy improvement. Fuel economy standards complemented by emissions-based vehicle registration fees can, and in fact already do, play an important role in OECD countries. Other countries, especially those with robust growth in vehicle use, need to adopt similar policies. All countries need to update these standards over time, rather than letting measures expire or stagnate. The Global Fuel Economy Initiative is focused on helping to achieve such outcomes (FIA Foundation, 2011).

Alternative fuels

Ethanol from sugar cane can already provide low-cost biofuels (depending on feedstock prices). Advanced (second-generation) biofuels, such as biofuels from waste and residues, ligno-cellulosic ethanol and biodiesel derived from biomass (biomass-to-liquids), appear to have the best long-term potential to provide sustainable, low life-cycle greenhouse gas fuels, but more RD&D is needed, as well as policy measures reducing the investment risk associated with commercial-scale plants. For all biofuels, important sustainability questions must be resolved, such as the impact of production on food security, sensitive ecosystems, greenhouse gas emissions and social aspects as a result of land-use change (Box 2.6).

Box 2.6. Biofuels and the food versus fuel debate

A considerable rise in agricultural commodity prices in 2006 - 2008 triggered a debate over the impact of conventional biofuels on global commodity prices and food security. This debate has cooled somewhat since then. Recent analyses suggest that biofuels had only a limited impact on those commodity price spikes, whereas rising oil prices and the use of commodities by financial investors in combination with adverse weather conditions probably were the main drivers behind the food price increase (World Bank, 2010).

Today only about 2% (30 million hectares) of the world's arable land is used to grow biofuel feedstocks. Plus in many cases, co-products occur that are used for energy generation or enter the food chain as a valued cattle feed, (*e.g.* 0.6 kilogram (kg) of dried distiller's grains per litre of corn-ethanol; 0.85 kg of soy-meal per litre of soy-biodiesel), and reduce the net land demand of biofuels. Biofuels should be promoted in a manner that encourages greater agricultural productivity and the use of degraded land. Biofuels impact on food security, nonetheless, remains a sensitive topic. A sound policy framework is required to ensure that biofuels are produced sustainably with regard to food security as well as other social, environmental and economic aspects. This should include adoption of sound certification schemes for biofuels based on internationally agreed sustainability indicators, for instance those being developed by the Global Bioenergy Partnership. Furthermore, land- and resource-efficient technologies, in particular advanced biofuels, need to be part of an integrated approach, as well as use of wastes and residues as biofuel feedstock (IEA, 2011f).

To ensure a vital and sustainable agricultural sector that can serve the wide range of biomass demand in different sectors in the future, substantial investments into agricultural production and rural infrastructure are needed. Sustainable biofuel production should be considered as one integrated aspect of land-use management, including promoting the use of degraded land along with production of food and other products. Biofuels can play a role in creating additional income in rural areas and trigger investments that benefit the agricultural sector as a whole. Integration of food and fuel production should provide opportunities for synergies which allow overall improvements in the efficiency with which land-based resources are produced and used.

Source: World Bank (2010), *Placing the 2006/08 Commodity Price Boom into Perspective*, IEA (2011), *Technology Roadmap – Biofuels for Transport.*

Advanced vehicle technologies

Policies and initiatives to promote electric vehicles and plug-in hybrid electric vehicle (PHEVs), and the continuing development of fuel cell vehicles, are extremely important. For governments, orchestrating the co-development of vehicle and battery production, recharging infrastructure, and providing incentives to ensure sufficient consumer demand to support market growth, will be a significant near-term challenge (Box 2.7). Demonstration programmes in selected regions or metropolitan areas that are keen to be early adopters can be an effective approach.

Advanced vehicle technologies will make a big impact, especially after 2020, not only in terms of transportation but also in how electricity networks are structured and managed. Electric vehicles are rapidly emerging as an important option, especially as lithium-ion battery costs decline. It now appears that batteries for a pure electric vehicle, in high-volume production, might cost as little as USD 500/kWh in the near term, low enough to bring the battery cost for a vehicle with a 150 kilometre range down to about USD 15 000. This is still very expensive. But with savings from removing the internal combustion engine, and with relatively low-cost electricity as the fuel, this might be sufficient to allow electric vehicles to achieve commercial success over the next five to ten years, if coupled with policy assistance such as support for the development of an appropriate recharging infrastructure. The cost of oil, the incumbent fuel, will also be an important factor. Since the impact of electric vehicles on CO_2 emissions depends on the carbon intensity of electricity generation, it would make sense to deploy electric vehicles first in those regions with already low CO_2 generation or firm commitments to move in that direction (IEA, 2009e).

A potentially important transition step to electric vehicles is offered by plug-in hybrid electric vehicles. By increasing the battery storage in hybrid vehicles and offering a plug-in option, these vehicles represent an important step toward vehicle electrification that builds incrementally on an emerging hybrid vehicle technology. For many drivers, running most of the first 40 kilometres per day on electricity could cut oil use dramatically, by 50% or more. PHEVs may also require less new infrastructure than pure electric vehicles since the car is not dependent solely on electricity and has a full driving range on liquid fuel (IEA, 2009e).

Box 2.7. France's strategy to launch electric vehicles

The French government committed USD 2.2 billion (EUR 1.5 billion) in October 2009 to a ten-year plan to help put two million plug-in electric vehicles on the road by 2020. The funds will help pay for:

- Manufacturer and buyer subsidies, including consumer purchase "bonuses" of up to EUR 5 000.
- Nationwide network of more than 4 million charging stations, with 1 million by 2015.
- Funding for battery manufacturing and industrial research.

The plan also includes supporting measures, such as requiring all new apartment developments to install charging stations, beginning in 2012. It calls for public and private tenders for electric vehicles to generate demand, with a target for these fleets to account for 100 000 by 2015.

The two major French car manufacturers, Renault and PSA Peugeot Citroën, have pledged to begin selling electric vehicles by 2012.

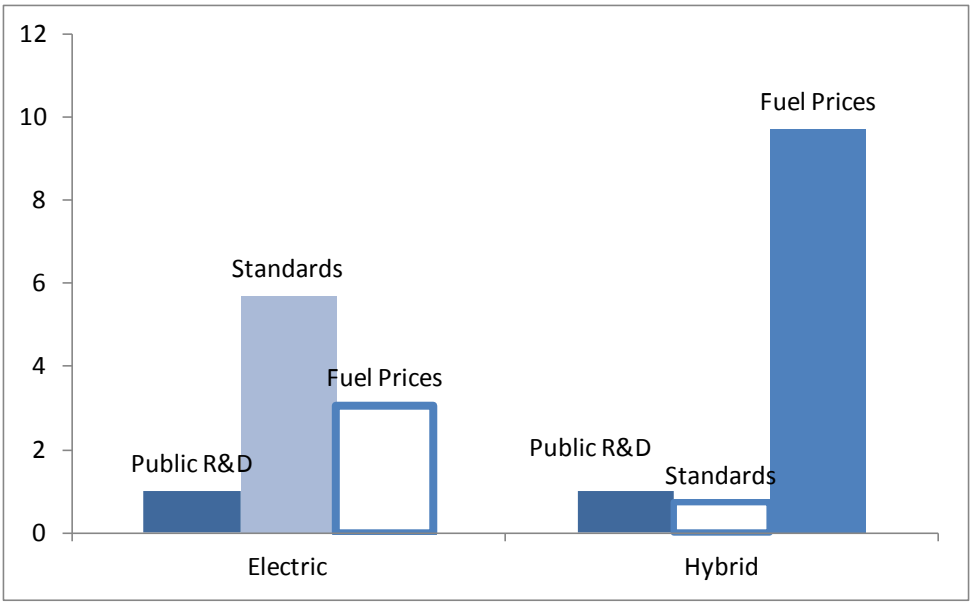
The government has named an electric vehicle co-ordinator to liaise between ministries, and to work closely with cities, electric utilities, vehicle manufacturers and other stakeholders to co-ordinate all aspects of electric vehicle development.

Source: French Ministry of Ecology press release (1 October 2009).

Recent OECD analysis indicates that relatively minor changes in a performance standard or automotive fuel prices would yield benefits in terms of innovation that are equivalent to a much greater proportional increase in public R&D budgets. However, there are significant differences between types of technologies. For example, in the case of electric vehicles the role of after-tax fuel prices is insignificant, but standards play an important role. Conversely, for hybrid vehicles it is after-tax fuel prices which are significant and not standards. Public R&D plays a much more important role for electric than hybrid vehicles (OECD, 2011a).

Figure 2.5 indicates the importance of the appropriate mix of policy measures. Relative prices may have a lesser role to play than ambitious performance standards or significant public support for research the further a technology is from being directly competitive with the incumbent technology (petrol- and diesel-driven technologies). While in theory a price sufficient to induce an equal level of innovation for such technologies could be introduced, such a measure would likely be politically infeasible in practice. Moreover, even if introduced, potential innovators may not perceive it as credible over the longer-term.

Figure 2.5. The effect of different factors on innovation in electric and hybrid vehicles



Note: For ease of interpretation, elasticities have been normalised such that effect of R&D=1. Unfilled bars indicate no statistical significance.

Source: OECD (2011), *Invention and Transfer of Environmental Technologies.*

Modal shifts and green urban models

Beyond changes to future vehicles and fuels, shifts in some passenger travel and freight transport to more efficient modes can also play an important role in greening transport and should be a policy focus. Certainly from the point of view of cities around the world, developing in a manner that minimises reliance on private motorised travel should be a high priority given the strong co-benefits in terms of reduced traffic congestion, lower pollutant emissions and general liveability.

Shifting passenger travel to more efficient modes such as urban rail and advanced bus systems can play an important role. Policies need to focus on better urban design to cut the need for motorised travel,

improving mass transit systems to make them much more attractive, and improving infrastructure to make it easier to walk and cycle for short trips. Rapidly growing cities in developing countries have the opportunity to move toward far less car-oriented development than has occurred in many cities in OECD countries. But it will take strong measures and political will, and support for alternative investment paradigms.

Notes

1 The percentage reductions are calculated as the difference in 2050 between emissions in the baseline and Blue Map scenarios and therefore do not reflect the full contribution of each technology compared to today's deployment level.

2 The OECD Framework for Assessing Green Growth Policies provides a thorough discussion of environmental externalities and key underlying market failures (de Serres, Murtin and Nicoletti, 2010). It reviews the relative strengths and weaknesses of different policy instruments and policy mixes to deliver green growth. Policy issues related to the development and diffusion of clean technologies are examined. Its taxonomy of policy tools and checklist of questions for green policy assessment can provide valuable guidance to policy makers' challenging tasks in providing an integrated strategy.

3 The G20 includes the G8 group of countries – Canada, France, Germany, Italy, Japan, Russian Federation, United Kingdom, United States – plus Argentina, Australia, Brazil, China, India, Indonesia, Mexico, Saudi Arabia, South Africa, Korea, Turkey and the European Union.

4 www.oecd.org/iea-oecd-ffss

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