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**NATIONAL APPROACHES FOR PROMOTING ECO-INNOVATION: COUNTRY PROFILES OF  
EIGHT NON EU OECD COUNTRIES**

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## FOREWORD

The report compiles country profiles on eco-innovation policies developed for the eight non-EU OECD members: Australia, Canada, Japan, Korea, Mexico, New Zealand, Turkey and the US. Country profiles are based on extensive desk research and on field missions in selected countries (Canada, Japan, Korea, the US). Draft documents have been reviewed by country experts identified by the countries delegations. Country experts have commented earlier drafts of their country profile.

The report complements the eco-innovation roadmaps developed by EU member countries under the Environmental Technology Action Plan. It provides an empirical basis for further investigation on policies to support eco-innovation. A similar report has been prepared for eco-innovation policies in China and will be published separately.

A short introduction presents the background for this report, including the methodology to develop the country profiles, and a brief overview of some of the instruments identified in the country profiles.

The report was drafted by Xavier Leflaive, under the supervision of Brendan Gillespie. Carla Bertuzzi has provided data and information on measurement issues and has drafted selected sections. IEEP was commissioned for the initial desk research and preliminary identification of policy issues. Country experts have provided most valuable inputs, in terms of time, information and policy relevance: Warren Hughes (Department of the Environment, Water, Heritage and the Arts, Australia), Javier A. Gracia-Garza (Environment Canada), Graham Campbell (Natural Resources Canada), Tim Karlsson (Industry Canada), Noriko Kishimoto (Ministry of the Environment, Japan), Kyu-Shik Park (Ministry of Environment, Republic of Korea), Carlos Muñoz Villarreal (Ministry of Environment and Natural Resources, Mexico), Vera Power and Alison Stringer (Ministry for the Environment, New Zealand), David Widawsky (USEPA), Sebahattin Dokmeci (Ministry of Environment and Forestry, Turkey).

A first version was discussed by the Working Party on Global and Structural Policies (WPGSP) in October 2008 and cleared for declassification, subject to revising in line with the comments received. For more information about this OECD project, please contact Xavier Leflaive ([xavier.leflaive@oecd.org](mailto:xavier.leflaive@oecd.org)).

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## TABLE OF CONTENTS

FOREWORD.....	2
INTRODUCTION.....	5
Background.....	5
Policy instruments to support eco-innovation.....	5
COUNTRY PROFILE OF AUSTRALIA.....	7
Introduction and country definitions of eco-innovation.....	7
Policies, initiatives and instruments – a national inventory.....	9
Country Synthesis.....	21
Appendices.....	23
COUNTRY PROFILE OF CANADA.....	26
Introduction and country definitions of eco-innovation.....	26
Policies, Initiatives and instruments – a national inventory.....	30
Country Synthesis.....	42
Appendices.....	45
COUNTRY PROFILE OF JAPAN.....	48
Introduction and country definitions of eco-innovation.....	48
Policies, Initiatives and instruments – a national inventory.....	54
Country Synthesis.....	64
Appendices.....	66
COUNTRY PROFILE OF THE REPUBLIC OF KOREA.....	68
Introduction and country definitions of eco-innovation.....	68
Policies, initiatives and instruments – a national inventory.....	71
Country Synthesis.....	82
Appendices.....	84
COUNTRY PROFILE OF MEXICO.....	87
Introduction and country definitions of eco-innovation.....	87
Policies, Initiatives and instruments – a national inventory.....	89
Country Synthesis.....	96
References.....	99
COUNTRY PROFILE OF NEW ZEALAND.....	100
Introduction and country definitions of eco-innovation.....	100
Policies, Initiatives and instruments – a national inventory.....	104
Country Synthesis.....	113
Appendices.....	115

COUNTRY PROFILE OF TURKEY .....	119
Introduction and country definitions of eco-innovation.....	119
Policies, Initiatives and instruments – a national inventory.....	120
country Synthesis .....	128
Appendices.....	130
COUNTRY PROFILE OF THE US.....	132
Introduction and country definitions of eco-innovation.....	132
Policies, Initiatives and instruments – a national inventory.....	136
Country Synthesis .....	154
Appendices.....	158

### Tables

Table 1. Estimated distribution of Australian environment industry activities .....	24
Table 2. Trends in environmental industry .....	85

### Figures

Figure 1. Environmental revenues by sector .....	47
Figure 2. The Strategies supporting Japan’s strategy for a sustainable society .....	53
Figure 3. The Top Runner Programme .....	57
Figure 4. Trend of R&D expenditure and ration of R&D to GDP .....	83
Figure 5. Innovation rate - Manufacturing.....	117
Figure 6. Innovation to reduce energy consumption or environmental impact.....	118
Figure 7. R&D budgets in US, Japan and the EU .....	136
Figure 8. Venture capital funding eco-innovation .....	160

### Boxes

Box 1. Industry-led voluntary performance targets .....	58
Box 2. Clean Energy Technology Export in Guatemala .....	153
Box 3. Institutionalised collaboration .....	155

## INTRODUCTION

### Background

This report is part of the OECD work programme on policies that support eco-innovation.

The ambition of this report is to provide an empirical inventory of policies in place in OECD countries to promote eco-innovation. Considering that European countries had developed roadmaps for eco-innovation policies in the context of the European Commission Environmental Technology Action Plan (ETAP), the secretariat prepared an inventory of eco-innovation policies in non-EU OECD countries (Australia, Canada, Japan, Korea, Mexico, New Zealand, Turkey and the US). A similar project was undertaken for China and is published separately.

The objective of this work is to complement the knowledge base on eco-innovation policies in OECD countries and to provide empirical material for additional research on policy issues related to eco-innovation. The outline of each country profile is similar to that of ETAP roadmap, to facilitate comparison.

The work was implemented in coordination with country delegations, which have identified experts in each country who could provide additional information and review initial drafts of the country profile of their country.

A consultant (IEEP, Brussels, Belgium) has been commissioned to collect all information publicly available in English on eco-innovation policies in each of the eight non-EU OECD members. Field missions have been organised by the country experts in four countries (Canada, Japan, Korea, the US). During these missions, the secretariat met with the agencies identified and selected by the country expert. Draft country profiles have been developed on the basis of desk research and field missions. They have been reviewed by national experts and revised accordingly. All country profiles present information which was up-to-date at the end of 2007. In most cases, more recent information has been taken into account.

### Policy instruments to support eco-innovation

The country profiles confirm that eco-innovation policies deploy a variety of instruments. They have to adjust to the features of the domestic economy, in particular the knowledge base, the size of domestic markets, and the *vigueur* of the venture capital industry.

In most non-EU OECD countries, public research and development (R&D) remains a major orientation. The US and Japan typically allocate significant public finance to environment-related R&D. However, three trends have emerged: i) some countries are concerned by the competition and trade issues related to such support; ii) public resources are increasingly channelled via Departments not directly in charge of environment policies (Energy, Agriculture, Transport), making inter-agency cooperation even more necessary; iii) the role of research organisations is being redefined, to intensify linkages with the private sector and stimulate the development of marketable outputs; incubators in the

US, or the National Institute of Advanced Industrial Science and Technology's (AIST) Technology Licensing Office in Japan illustrate innovative arrangements in this area.

Attracting private funds to finance environmental R&D is another major policy orientation. The main issue is to reduce risks for private investors investing in environmental R&D projects, while making sure that public money is used effectively and does not crowd out private initiatives. A variety of funds have been established to reduce risks to private investors (e.g. Sustainable Technology Development Canada-SDTC in Canada), or incubators (e.g. The Clean Energy Alliance in the US, Environmental Technology Business Incubator in Korea). Measures are taken to stimulate the venture capital industry and to provide incentives for environment-related projects; e.g. this is the role of the Environmental Venture Fund in Korea.

Environment-related performance standards are being set with the aim of stimulating innovation in goods and services. Such standards are pursued in particular in the field of energy and resource efficiency. However, standards may provide disincentives and can only have a lasting positive effect on innovation if they are timely revised. Schemes such as the Top Runner programme in Japan aim to address this challenge.

Market-based instruments are burgeoning in non-EU OECD Countries. A number of new projects and initiatives have been identified at national or local level. One interesting case is the all-encompassing Emission Trading Scheme envisioned in New Zealand, where equitable sharing of responsibility across sectors and stakeholders is based on the principle of equity across sectors.

There is some evidence that, besides environmental policy instruments and regulation, soft instruments such as voluntary commitments, eco-audits and eco-labels play a role as determinants of innovative behaviour in firms. Voluntary initiatives can become mandatory over time (cf. Stand-by Korea). Industry initiatives abound and, in particular contexts, can change the relationship between the administration in charge of environment policies and the business sector. This is illustrated by Performance Tracks in the US, where the US Environmental Protection Agency (USEPA) and firms enrolled in the programme construct a collaborative relationship. This typifies what can be seen as a new phase in environmental policies which sets out to promote broader sustainability, rather than address one single environmental issue. In that perspective, governments rely less on regulatory tools and endeavour to work with industries, in sectors which use materials and/or energy.

In line with the OECD Council Recommendation on Improving the Environmental Performance of Public Procurement [C(2002)3], green procurement initiatives are burgeoning at local and national levels. Guidelines are supported by websites, green products databases, and *pro forma* requests for tenders. The Green Purchasing Network is an international network active in this area.

Some initiatives set out to promote technologies and products developed by one country. Others try to alleviate barriers to the deployment of environment-friendly technologies and products; shared definitions, standards and labels contribute to a level playing field for the creation and diffusion of environment-friendly technologies, products and life-styles. Such efforts are still plagued by institutional problems related to intellectual property rights and international monetary transfers. Typically, the capacity of a national agency to (financially) support one country's side of a multinational joint venture depends on how countries will share the intellectual property rights. Few cooperation projects reach developing countries (with the exception of East Asia, and China in particular).

## **COUNTRY PROFILE OF AUSTRALIA**

### **Introduction and country definitions of eco-innovation**

#### ***Definitions related to eco-innovation used in the Country***

Two definitions have been found from Australian institutions, which both refer cleaner production and consumption.

The Victorian Eco-Innovation Lab, when referring to eco-innovation, states that<sup>1</sup>: “We need a paradigm shift in the way that we think about systems of production and consumption, and about quality of life and prosperity. This is what we mean by eco-innovation.”

According to Banksia, the Australian environmental Foundation that awards eco-innovation projects, eco-innovation refers to<sup>2</sup>:

- Eco Efficiency, defined as producing more goods and services with less energy and fewer natural resource;
- Cleaner Production, seen a strategy to continuously reduce pollution and waste at the source; and
- Eco-Design, i.e. the re-design of a product or process to reduce its environmental impacts all along its life-cycle.

#### ***Institutions playing a major role on eco-innovation***

The information provided in this report is mainly based on initiatives taken by the following institutions.

##### *Department of the Environment and Water Resources*

The Australian Department of the Environment and Water Resources develops and implements national policies, programmes and legislation to protect and conserve Australia's natural environment and cultural heritage. Some initiatives are related to environment and innovation. (<http://www.environment.gov.au/index.html>).

The Australian Greenhouse Office (AGO) is part of the Department of the Environment and Water Resources. It delivers the majority of programmes under the Australian Government's climate change strategy. (<http://www.greenhouse.gov.au/>).

<sup>1</sup> <http://www.ecoinnovationlab.com/pages/about.php>

<sup>2</sup> <http://www.banksiafdn.com/index.php?page=242>

*Department of Industry, Tourism and Resources*

The Department of Industry, Tourism and Resources aims to encourage growth and sustainability of Australian industries through innovation, investment and international competitiveness. (<http://www.industry.gov.au/>)

*Office of the Renewable Energy Regulator (ORER)*

The ORER is a statutory authority established to oversee the implementation of the Australian Government's mandatory renewable energy target (MRET).

<http://www.orer.gov.au/about/index.html>

*Good Environmental Choice Australia (GECA)*

GECA Ltd. (previously known as the Australian Environmental Labelling Association) delivers Australia's national eco-labelling programme, and aims to: provide incentives for suppliers to reduce the environmental impacts of products sold in Australia; provide guidance to consumers and encourage them to purchase green products; recognise genuine moves by companies to reduce the adverse environmental impacts of their products; and improve the quality of the environment and encourage the sustainable management of resources.

<http://www.geca.org.au/AELAobjectives.htm>

*Victorian Eco Innovation Lab (VEIL)*

VEIL is a think tank funded by the Victorian government through the Victorian Sustainability Fund as part of the government's Sustainability Action Statement (2006). VEIL is a project of the Australian Centre for Science Innovation and Society at the University of Melbourne. Its aim is to 'change the landscape of expectations of a sustainable future' and 'open-up the eco-innovation space in the Victorian economy'. Among its activities, VEIL carries on interdisciplinary research, tests innovative products and influences investment and social choices to expand the market for eco-innovation. (<http://www.ecoinnovationlab.com/>)

*Banksia Environmental Foundation*

The Banksia Environmental Foundation, established in 1989, is a national not-for-profit organisation that promotes environmental excellence and sustainability through awards programme and other associated events. (<http://www.banksiafdn.com/index.php>)

***Policy documents related to eco-innovation****Australia's Climate Change Policy (2007)*

Australia's climate change policy framework promotes, among other initiatives, the development of low emissions technologies and the improvement of energy efficiency.

[http://www.pmc.gov.au/publications/climate\\_policy/index.cfm](http://www.pmc.gov.au/publications/climate_policy/index.cfm)

*National Climate Change Adaptation Framework (2006)*

The Framework aims to address key demands from business and the community for targeted information on climate change impacts. A key focus is to help decision makers understand and incorporate climate change into policy and operational decisions. The Framework mentions, among other tools, new adaptation technologies.

[http://www.coag.gov.au/meetings/130407/docs/national\\_climate\\_change\\_adaption\\_framework.pdf](http://www.coag.gov.au/meetings/130407/docs/national_climate_change_adaption_framework.pdf)

*Energy White Paper Securing Australia's Energy Future (2004)*

The document establishes a long term policy framework for Australian energy. It includes a range of initiatives to fund environmental technology (e.g. GHG reduction technologies, Solar Cities, energy efficiency assessment, etc.)

[http://www.dpmpc.gov.au/publications/energy\\_future/index.htm](http://www.dpmpc.gov.au/publications/energy_future/index.htm)

*The Australian National Research Priorities*

The Priorities were announced in 2002, and referred to *an environmentally sustainable Australia*. Core objectives include:

- Transforming existing industries; this requires new technologies for resource-based industries to deliver substantial increases in national wealth while minimising environmental impacts on land and sea; and
- Reducing and capturing emissions in transport and energy generation, via alternative transport technologies, clean combustion and efficient new power generation systems, and capture and sequestration of carbon dioxide.

[http://www.dest.gov.au/sectors/research\\_sector/policies\\_issues\\_reviews/key\\_issues/national\\_research\\_priorities/](http://www.dest.gov.au/sectors/research_sector/policies_issues_reviews/key_issues/national_research_priorities/)

**Policies, initiatives and instruments – a national inventory**

Given the high number of Australian initiatives on eco-innovation, the report provides some insights on selected instruments, focusing on the most recent national policies, plans and projects. Some examples of regional/local initiatives are provided as well.

## ***Research and Development***

### *Backing Australia's Ability*

The programme, announced in 2004, consisted of an AUS\$5.3 billion package of funding for science and innovation. The package builds on an initial investment of AUS\$3 billion over five years to 2005-06<sup>3</sup>. Overall, the two packages constitute an investment of AUS\$8.3 billion over 10 years to 2010-11, and bring the Government's total commitment to science and innovation over the period to about AUS\$52 billion. The programme is designed to: strengthen Australia's ability to generate ideas and undertake research; accelerate the commercialisation of ideas; and develop and retain scientific skills. The programme covers environmental innovation.

For instance, the Government has committed \$305 million over seven years (from July 2004 onwards) to the *Commonwealth Scientific and Industrial Research Organisation (CSIRO) National Flagships Initiative*. Flagships are large-scale collaborative partnerships which link CSIRO with organisations across Australia to research areas of national need, including 'Water for a Healthy Country' (to achieve a tenfold increase in the social, economic and environmental benefits from water by 2025) and 'Energy Transformed' (to halve greenhouse gas emissions and double the efficiency of the nation's new energy generation, supply and end use, and to position Australia for a future hydrogen economy).

More details on other initiatives and single projects can be found at <http://backingaus.innovation.gov.au/>.

### *Renewable Energy Development Initiative (REDI)*

REDI was a programme launched in 2004 supporting renewable energy innovation and commercialisation. It provided grant funding up to AUS\$100 million in competitive grants to Australian businesses over seven years for research and development (R&D), proof-of-concept, and early-stage commercialisation projects with high commercial and greenhouse gas abatement potential. This programme ceased funding new projects in January 2008. Projects with contracts in place before this will continue until completion.

See: <http://www.ausindustry.gov.au/content/level3index.cfm?ObjectID=B7C70A4B-E588-40C9-AD6542408BFD1AAB&L2Parent=AEB901E5-7CB8-4143-A3BF33B2423F9DA6>

## ***Performance Targets***

The most relevant performance targets in Australia include:

- Mandatory Renewable Energy Target;
- Green Power Scheme;
- Building Code Australia (BCA);
- National Average Fuel Consumption (NAFC) target;
- Green light Australia.

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<sup>3</sup> Backing Australia's Ability - An Innovation Action Plan for the Future

*Mandatory Renewable Energy Target (MRET) and Clean Energy Target (CET)*

The aim of the renewable energy target is to increase the production of renewable energy: all electricity retailers and wholesale buyers have a legal liability to contribute towards the generation of additional renewable energy. They meet their legal obligation by acquiring renewable energy certificates (REC); certificates can be traded in the REC market, at market price. The Australian Government is committed to reach 9,500GWh of renewable energy by 2010.

Furthermore, in 2007 the Australian Government introduced a comprehensive renewable and low-emission energy target, which builds on the market-based framework of the MRET. The new national Clean Energy Target (CET) will be 30,000 gigawatt hours of low-emissions energy generation by 2020<sup>4</sup>.

*Achievements:* the MRET has stimulated AUS\$3.5 billion of investment in renewable energy technologies since its introduction in 2001. See: <http://www.greenhouse.gov.au/markets/mret/>

*Green Power Scheme*

GreenPower is a national accreditation programme established in 1997, which sets stringent environmental and reporting standards for renewable electricity products offered by energy suppliers to households and businesses across Australia. It aims to increase Australia's capacity to produce environmentally friendly renewable electricity by driving demand for alternative energy generation.

See: [www.greenpower.com.au](http://www.greenpower.com.au)

*Achievements:* since 1997 more than 590,000 customers bought Green Power, resulting in savings of nearly 4.2 million tonnes of GHG emissions.

*Building Code Australia (BCA)*

BCA is managed by the Australian Building Codes Board (ABCB, [www.abcb.gov.au](http://www.abcb.gov.au)) on behalf of the Australian Government and State and Territory Governments. Its goal is to enable the achievement of minimum necessary standards of relevant health, safety, amenity and sustainability objectives efficiently. The BCA was revised in 2006 to include new Minimum Energy Performance Standards (MEPS) for all classes of buildings.

The Australian government has agreed to implement a consistent Nation-wide House Energy Rating Scheme (NatHERS - <http://www.nathers.gov.au/>) to enable households to improve the energy efficiency of their homes and to make more informed choices about housing purchases and renovation.

*National Average Fuel Consumption (NAFC) target*

In 2003, the Government reached agreement with the automotive industry to progressively reduce carbon dioxide emissions and fuel consumption of new passenger cars and other light vehicles supplied to the Australian market.

The Federal Chamber of Automotive Industries (FCAI) has adopted a Voluntary Code of Practice which includes a target reduction for national average fuel consumption (NAF) for new petrol fuelled

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<sup>4</sup> <http://www.environment.gov.au/minister/env/2007/pubs/mr24sep07.pdf>

passenger cars of 6.8 litres per 100 kilometres by 2010, and appropriate targets in greenhouse gases emission reductions for other new light vehicles by 2010.

See: [http://www.autoindustries.com.au/code\\_reducing\\_fuel.php](http://www.autoindustries.com.au/code_reducing_fuel.php)

*Achievements:* this is expected to represent an 18% improvement in the fuel efficiency of new vehicles between 2002 and 2010<sup>5</sup>.

### *Greenlight Australia*

Greenlight Australia provides a framework for reducing energy consumption from Australian lighting over the ten-year period, following a 2005 commitment of the Australian governments and the Australian lighting industry to reduce the energy consumption of lighting by 20% by 2015. <http://www.energyrating.gov.au/library/pubs/200418-greenlight.pdf>

### ***Mobilisation of Financing***

In addition to the public budget allocated to R&D mentioned above, some important investment programmes exist at both national and local levels. Some cover the whole spectrum of environmental technologies (e.g. Advanced Electricity Storage Technologies), others are domain-specific (Australian Government Water Fund).

### *National Plan for Water Security*

The Australian Government's \$10 billion 10-year National Plan for Water Security aims to put rural water use on a sustainable footing. \$5.9 billion have been allocated for modernising irrigation, of which \$38.1 million is allocated for 2007-08. In particular, \$1.5 billion will be spent for the On-Farm Irrigation Efficiency Programme. The funded pilot projects will help fine tune how best to stimulate private investment in efficient on-farm irrigation.

See: <http://www.environment.gov.au/water/action/npws.html>

### *Australian Government Water Fund*

The Fund, run by the Australian Government, is a \$2 billion programme over 2005-2010 funding water infrastructure, improved water management, and better practices in the stewardship of Australia's scarce water resources. The Fund supports field water projects that will improve Australia's water efficiency and environmental outcomes. The Fund comprises three programmes (see: <http://www.nwc.gov.au/agwf/index.cfm>):

- Water Smart Australia (AUS\$ 200 million); it accelerates the development and uptake of smart technologies and practices in water use;
- Raising National Water Standards (AUS\$ 1.6 billion from 2005 to 2010); it assists the development of the necessary tools for good water management;
- Community Water Grants programmes (AUS\$ 200 million); it promotes community engagement, awareness and investment in saving and conserving water and encourages best practices.

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<sup>5</sup> [http://www.greenhouse.gov.au/transport/env\\_strategy.html#nafc](http://www.greenhouse.gov.au/transport/env_strategy.html#nafc)

*Advanced Electricity Storage Technologies (AEST)*

The 5 year, AUS\$20.5 million programme was launched in June 2004 and is run by the Department of Resources, Energy and Tourism. The programme identifies and promotes strategically important storage technologies in order to increase the share of renewable energy-based electricity generation in the supply system.

See: [http://www.ret.gov.au/ Advanced Electricity Storage Technologies](http://www.ret.gov.au/Advanced%20Electricity%20Storage%20Technologies)

*Achievements:* By October 2008, five projects have been funded, for an overall investment of about AUS\$18.5 million.

*Low Emissions Technology Demonstration Fund*

The AUS\$410 million Fund supports the commercial demonstration of technologies that have the potential to deliver large-scale greenhouse gas emission reductions in the energy sector. It operates from 2005-06 to 2019-20.

*Achievements:* In 2006 the government committed AUS\$ 60 million to develop the then-world's-largest carbon capture and storage (CCS) project in Western Australia.

See: [http://www.ret.gov.au/Low Emissions Technology Demonstration Fund](http://www.ret.gov.au/Low%20Emissions%20Technology%20Demonstration%20Fund)

*Biofuel Capital Grants*

The fund, run by the Department of Industry, Tourism and Resources, was launched in 2003. It provided one-off capital grants to projects providing new or expanded biofuels production capacity. The amount of each grant was calculated on the basis of 16 cents per litre of new or expected production capacity to be built. As of 2007, this program's funds had been entirely disbursed<sup>6</sup>.

*Local Greenhouse Action*

Local Greenhouse Action is an AUS\$13.8 million Australian Government initiative which assists local government, communities and individual households in reducing their greenhouse gas emissions, particularly in the areas of energy use, transport and waste. Introduced in May 2004, the measure builds on three initiatives: Cities for Climate Protection (CCP), Travel Demand Management, and Cool Communities.

The CCP programme has been funded by the Australian government for 11 years. CCP is primarily a capacity building programme, encouraging investigation and support for any activity with significant greenhouse gas abatement potential within council operations, the local community and local industry/commerce. CCP is internationally trademarked by the International Council for Local Environmental Initiatives (ICLEI) and has been delivered across Australia by ICLEI-Oceania.

See: <http://www.environment.gov.au/settlements/local/ccp/index.html>

*Achievements:* The CCP programme has engaged 233 local governments to work on emission reductions. Together, these councils represent 84% of Australia's population. Total emission

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<sup>6</sup> <http://www.iea.org/Textbase/pm/?mode=re&id=2142&action=detail>

reductions by councils over the life of the CCP programme from 1997 to 2008 exceed 18 million tons of CO<sub>2</sub> equivalent<sup>7</sup>.

#### *Low Emissions Technology and Abatement (LETA)*

LETA, launched in 2005, is a AUS\$26.9 million measure run by the Australian GHG Office to reduce GHG emissions by supporting the identification and implementation of cost effective abatement opportunities and the uptake of small-scale low emission technologies in business, industry and local communities.

See: <http://www.environment.gov.au/settlements/programs/leta/>

#### *Measures for a Better Environment*

*Measures for a Better Environment* is a package of five greenhouse gas reduction programmes. It was initiated in 2000, for 4 years; some components have been extended. It is managed by AGO and covers a number of initiatives, including:

- *Solar Homes and Communities Plan (SHCP)*: cash rebates are available to households, schools and owners of community buildings to install grid-connected or stand-alone photovoltaic systems. In 2007 the Government announced an AUS\$150 million extension to the *Photovoltaic Rebate Programme* over 5 years, bringing the total investment to AUS\$211.8 million.

See: <http://www.environment.gov.au/settlements/renewable/pv/index.html>

- *Renewable Remote Power Generation Programme (RRPGP)*: it provides financial support to increase the use of renewable generation in remote parts of Australia presently relying on fossil fuel for electricity supply. Around AUS\$285 million will be available over the life of the RRPGP, extended until 2010-11.

See: <http://www.environment.gov.au/settlements/renewable/rrpgp/index.html>

#### *Renewable Energy Equity Fund (REEF)*

Launched in 1997, REEF is a government initiative which provides venture capital for small innovative renewable energy companies. This includes companies which are commercialising or producing renewable energy technologies and services, providing there is an innovative development being commercialised. Investments are managed by CVC REEF Investment Managers Ltd.

See: <http://www.environment.gov.au/settlements/renewable/reef/index.html>

#### *Solar Cities*

Solar Cities is an AUS\$94 million initiative launched in 2004 and implemented by the Department of the Environment, Water, Heritage and the Arts. It is designed to demonstrate how solar power, smart meters, energy efficiency and new approaches to electricity pricing can combine to provide a sustainable energy future in urban locations. The initiative will provide funding to support

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<sup>7</sup> <http://www.greenhouse.gov.au/local/ccp/index.html>

significant penetration of solar technologies and energy efficiency in seven urban areas: Adelaide, Townsville, Blacktown, Alice Springs, Central Victoria, Moreland and Perth.

See: <http://www.environment.gov.au/settlements/solarcities/>

#### *Ethanol Distribution Programme*

The Ethanol Distribution Programme was established by the Australian Government in 2006. The purpose is to increase the number of retail service stations selling 10 per cent ethanol blended petrol (E10); increase the volume of E10 sold; and encourage the sale of E10 at a lower price than regular unleaded petrol. The programme provides grants of up to AUS\$20,000 for retail service stations to reduce the cost of installing or converting infrastructure to supply E10.

#### *Example of regional funding: Launceston Clean Air Industry Programme*

The programme is a AUS\$1 million Australian Government initiative to improve air quality in the Launceston region. It started in July 2005 and ceases in June 2008. It is designed to assist eligible companies to reduce emissions of particles from their facilities through changes to technology or processes (for example, replacement of wood-fired boilers with gas boilers) or through the installation of pollution control equipment.

<http://www.environment.gov.au/atmosphere/programs/launceston-caip/index.html>

#### **Market-based Instruments**

Significant market-based instruments promoting eco-innovation in Australia include:

- Renewable Energy Certificates (RECs, see above),
- National Solar School Programme,
- Solar Hot Water Rebates Programme,
- Fuel Tax Reform,
- Emission trading.

#### *Solar Hot Water Rebates Programme*

Rebates of AUS\$1,000 are available in eligible circumstances to install solar and heat pump hot water systems to replace electric storage hot water systems in existing privately owned homes. The rebate is offered for systems installed on, or after 18 July 2007 until March 2012. The overall cost of the measure is around AUS\$225 million over five years.

See: <http://www.environment.gov.au/settlements/renewable/solarhotwater/>

#### *National Solar School Programme (formally Green Vouchers for School Programme)*

This programme will help primary and secondary schools around the country take practical action to save energy and water while cutting their utility bills. National Solar Schools offers grants to up to AUS\$50,000 (GST exclusive) to install solar and other renewable power systems, solar hot water systems, rainwater tanks and a range of energy efficiency measures. The programme runs until 30 June 2015 and AUS\$480.6 million will be allocated over 8 years.

See: <http://www.environment.gov.au/settlements/renewable/nationalsolarschools/index.html>

### *Fuel Tax Reform*

In 2003, the Government introduced an excise tax on ethanol and biodiesel, accompanied by a subsidy that reduces the effective excise for a transitional period. These subsidies are progressively reduced, raising the effective excises for untaxed fuels from zero, before 2011, to their final rates in 2015. The reforms aim to establish a fairer and more transparent fuel excise system, and enable currently untaxed fuels to establish their commercial credentials in the marketplace.<sup>8</sup>

[www.pmc.gov.au/publications/energy\\_future/index.htm#fuel\\_reform](http://www.pmc.gov.au/publications/energy_future/index.htm#fuel_reform)

### *Emission Trading*

In 2007 Australian Government committed to introduce a 'cap and trade' emissions trading scheme (ETS), which will include:

- a long-term emissions abatement goal and an associated emissions pathway;
- the largest coverage of emission sources, compared to other ETS in the world;
- a system of permit allocation that compensates businesses that suffer a disproportionate loss in asset values; ameliorates the carbon-related exposures of existing and new investments in the trade exposed emissions intensive sector until key international competitors face similar constraints; allows for the auctioning of remaining permits; and provides abatement incentives;
- recognition of credible domestic and international carbon offsets; and
- capacity to link to other national and regional schemes.

Trading under the scheme should start in 2012. In 2008, following careful economic modelling, the government will announce a long term emission abatement goal.

See: [http://www.pmc.gov.au/climate\\_change/emissions/index.cfm](http://www.pmc.gov.au/climate_change/emissions/index.cfm)

### *Procurement*

Australia is part of the *Green Purchasing Network*, an international network which aims to promote the spread of environmentally friendly products and services and green purchasing activities, share information and know-how internationally, and harmonise the efforts on green purchasing.

In addition, a number of initiatives are taken at national and regional level, including:

- Commonwealth Fleet Target
- Green Procurement website
- Local initiatives (ECO-Buy, Buy Recycled Alliance).
- Local, national and international policies, regulations and guidelines

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<sup>8</sup> <http://www.iea.org/Textbase/pm/?mode=cc&id=1335&action=detail>

*Commonwealth Fleet Target*

In February 2003 the Government agreed on an environmental target covering approximately 8,000 vehicles within the Commonwealth Tied Contract Fleet based upon the Green Vehicle Guide rating scheme (see chapter 2.6 below). The target aims to increase the proportion of government vehicles with lower pollutant emissions from 18% to 28% by December 2005. The target will be reviewed in 2008<sup>9</sup>.

*Australian Green Procurement website*

The website provides information on best practice Green Procurement research projects, offers a green products database and gives access to guidance materials helping draft terms of reference for green goods or services.

See: <http://www.geca.org.au/green-procurement/home-welcome.htm>

*Local initiatives*

According to the 2004 State of Green Procurement report, the progress in green procurement is mainly coming from individual councils and state municipal association. Two local initiatives are briefly described below.

*ECO-Buy*

ECO-Buy is the Victoria's local government green purchasing programme. It was initiated in 2002 and will last as a free service until 2009, to support the development of supply, demand and expertise. It works primarily with Victorian Councils to increase their purchasing of recycled, greenhouse friendly, water saving, non-toxic and other green products<sup>10</sup>. It provides a range of free services to facilitate green public purchasing, including guidance documents, data bases, training, networking opportunities...

It is being extended to five states and to New Zealand.

See: <http://www.ecobuy.org.au/>

*NSW Buy Recycled Alliance*

The aim of the Local Government Buy Recycled Alliance is to encourage and assist local governments to purchasing products containing recycled material. It is a joint undertaking by the Local Government Association of New South Wales (NSW) and Shires Association of NSW, together with the Department of Environmental and Conservation (NSW)<sup>11</sup>.

*Awareness raising and training*

Awareness raising and training programmes include voluntary agreements, labelling and other instruments, which can stimulate demand for eco-innovation.

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<sup>9</sup> [http://www.greenhouse.gov.au/transport/env\\_strategy.html#nafc](http://www.greenhouse.gov.au/transport/env_strategy.html#nafc)

<sup>10</sup> Good Environmental Choice Australia, 2004: *the State of Green Procurement in Australia*.

<sup>11</sup> Good Environmental Choice Australia, 2004: *the State of Green Procurement in Australia*

### *Voluntary agreements*

#### Voluntary Building Industry Initiatives Programme

The Programme of the Australian Greenhouse Office (AGO) assists the building industry in ensuring the energy-efficient practice of building and construction professionals. Projects developed with the support of the Government include:

- *Window Energy Rating Scheme (WERS)*: in 2001 the window and glazing industry, supported by the Commonwealth government, launched a system of energy performance labelling for window products. The scheme was designed to inform consumers and influence purchase decisions. See: <http://www.wers.net/>
- *Water Efficiency Labelling and Standards (WELS)*: the scheme requires certain products to be registered and labelled on the basis of their water efficiency, in accordance with the standard set under the *Water Efficiency Labelling and Standards Act 2005*. The scheme became mandatory for certain products as of July 2006. See: <http://www.waterrating.gov.au/>



#### Generator Efficiency Standards

In 2000 Australia introduced a voluntary measure for fossil fuel electricity generators to reduce the greenhouse intensity of energy supply. The measure is implemented through legally-binding 5-year Deeds of Agreement between the Government and participating businesses. The standards are reviewed every five years.

See: <http://www.greenhouse.gov.au/ges/index.html>

#### Greenhouse Challenge Plus

*Greenhouse Challenge Plus* enables Australian companies to form working partnerships with the Australian Government to improve energy efficiency and reduce greenhouse gas emissions. It builds on the Greenhouse Challenge programme, combining Greenhouse Friendly™ (<http://www.greenhouse.gov.au/greenhousefriendly/index.html>) and the Generator Efficiency Standards into a single industry programme.

Through *Greenhouse Challenge Plus*, the Australian Government enters into legally binding Deeds of Agreement with some fossil-fuelled power generating plants, to assess their operations and compare these with best practice bands for their technology classes and fuel types set out in the GES Technical Guidelines. The aim is to achieve movement towards best practice in the efficiency of fossil-fuelled electricity generation. (<http://www.greenhouse.gov.au/ges/index.html>)

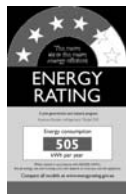
*Achievements*: The City of Melbourne joined *Greenhouse Challenge Plus* in 2000. It reported 5,448t CO<sub>2</sub>-e of abatement in the 2002/2003 financial year (i.e. more than 28 per cent of the council's emissions). The city is now aiming for zero net emissions by 2020, through encouraging improvements in energy efficiency, the use of renewable energy and sequestration<sup>12</sup>.

<sup>12</sup> <http://www.greenhouse.gov.au/challenge/members/cityofmelbourne.html>

*Labelling and rating schemes*

## Energy Rating Label and Minimum Energy Performance Standards

Certain electrical appliances (refrigerators and freezers, washers, air conditioners, etc.) supplied in Australia are requested to carry an approved energy label - the Energy Rating Label. Some appliances are requested to meet minimum energy efficiency levels as well (Minimum Energy Performance Standards - MEPS). A website allows consumers to compare the energy ratings and running costs of appliances. It is a joint initiative of Commonwealth, State, and Territory government agencies. The standards are developed in conjunction with New Zealand.



See: <http://www.energyrating.gov.au/>

## Australian Building Greenhouse Rating (ABGR) scheme

The ABGR scheme, launched in 2001 and managed by the government, provides accredited assessments of the greenhouse intensity of office buildings by awarding a star rating on a scale of one to five. See: [www.abgr.com.au/](http://www.abgr.com.au/)

## Good Environmental Choice Label

The Good Environmental Choice Label, developed by Good Environmental Choice Australia, is an environmental labelling program which indicates the environmental performance of a product. The label is awarded to products that meet voluntary environmental performance standards which have been created and assessed in conformance to international environmental labelling standards. See: <http://www.geca.org.au/homefront.htm>

*Awards and other instruments*

## Energy Allstars

Energy Allstars provides consumers with an online database of the most energy efficient appliances and commercial and industrial equipment for sale in Australia.

See: <http://www.energyallstars.gov.au/index.html>

## Green Vehicle Guide

The initiative, launched in 2004 and run by AGO and the Department of Transport and Regional Services, is an internet database providing information on the environmental performance of all new light vehicles supplied in Australia. The GVG provides also an overall environmental star rating reflecting air pollution and greenhouse gas emissions.

See: [www.greenvehicleguide.gov.au](http://www.greenvehicleguide.gov.au)

## Your Home web site

'Your Home' web site is a suite of consumer and technical guide materials and tools developed to encourage the design, construction or renovation of homes to be comfortable, healthy and more environmentally sustainable.

See: <http://www.greenhouse.gov.au/yourhome/about/index.htm>

#### Sustainable House Day

The Sustainable House Day is a yearly event entering its 6th year of operation. Its aim is to showcase sustainable design in existing houses, to encourage visitors to adopt sustainable design features.

See: <http://www.solarhouseday.com.au/>

#### Top Energy Saving Award Winner (TESAW)

This is an award created by the Australian government to recognise the most efficient star rated products on the market. It applies to both electric and gas products that carry a star rating energy label. It aims to help consumers identify the most efficient products on the market.

See: [www.energyrating.gov.au/tesaw-main.html](http://www.energyrating.gov.au/tesaw-main.html)

#### Banksia Eco Innovation Award

The prize is awarded for outstanding projects, practices and programs that result in significant increases in the efficiency of energy and materials usage and /or significant reduction in resource use, and/or significant reduction in waste generated, from a life-cycle perspective

<http://www.banksiafdn.com/index.php?page=242>

#### *Acting Globally*

Australian Government expenditure on international science and technology, excluding defence and industry-assistance measures, is estimated at AUSD\$211 million a year. This represents about 6 per cent of the Government's total science and technology expenditure, the same proportion as in the US. Several initiatives promote international collaboration in science and technology, though not specifically targeted to eco-innovation (e.g. the International Science Linkages Programme<sup>13</sup>, or the Forum for European–Australian Science and Technology Cooperation<sup>14</sup>).

Bilateral Climate Action Initiatives (CAP) is an international initiative which explicitly refers to environment and technology or innovation.

#### *Bilateral Climate Action Initiatives (CAP)*

The Australian Greenhouse Office (AGO) has concluded bilateral climate change partnerships with China, the European Union, Japan, New Zealand, the United States, and South Africa, which provides market opportunities for greenhouse technologies, products and expertise from Australia, and

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<sup>13</sup> <http://cordis.europa.eu/erawatch/index.cfm?fuseaction=ri.content&countryCode=AU&topicID=373&parentID=4>

<sup>14</sup> <http://www.feast.org/>

broadens Australian participation in climate change action by encouraging direct involvement by industry, business, scientists and communities.

[www.greenhouse.gov.au/ago/background/cap.html](http://www.greenhouse.gov.au/ago/background/cap.html)

## **Country Synthesis**

### *Role of globalisation*

Australian Government expenditure on international science and technology, is relatively high (AUS\$211), although not specifically targeted on eco-innovation.

Bilateral climate action partnerships have been signed with a number of countries to promote market opportunities for greenhouse technologies, products and expertise.

Australia is planning to establish its own emission trading scheme, which should have the capacity to link to other national and regional schemes.

### *Lessons*

Many initiatives promoting environmental innovation are related to funding –financing not only the R&D phase, but more frequently the general implementation of projects. Many investments are focussed on energy efficiency, renewable energy and emissions reductions. Some funds are also earmarked to water management and technologies, since water scarcity is a burning issue in Australia.

There are also a large number of performance targets, many of which on energy efficiency. Important targets are especially the Mandatory Renewable Energy Target and the Clean Energy Target. A target on vehicle fuel efficiency was also agreed with the automotive industry.

Several initiatives are voluntary, like some of the performance targets (e.g. the Generators Efficiency Standards, the Voluntary Code of Practice in the context of the national Fuel Consumption Target, etc.). In addition to these, Australia proposes also a relatively large number of voluntary labels, such as on energy efficiency for electronic products, buildings, vehicle fuels etc.

Among the market based instruments available in Australia, one of the most noteworthy are the Renewable Energy Certificates, which aims to help achieve the national renewable energy target and are tradable. It will also be interesting to see the development of the Australian Emission Trading System, expected to be in place by 2012, and the potential linkages with the European system.

In addition to the national initiatives, there are also a number of regional/state initiatives targeted to local needs and projects – e.g. related to funding and to green procurement. At international level, Australia has concluded a number of bilateral climate change partnerships with developing and developed countries, including the EU.

In general, many initiatives in Australia are focused on promoting energy efficiency, either by setting standards, labels, funding or through awareness rising. Some interesting tools – in particular performance targets and labels - promote energy efficiency in buildings, while other are focussed on improving emission from products – like electrical appliances – and vehicle fuels.

*Renewable Energy Development Initiative (REDI)*

*Mandatory Renewable Energy Target (MRET) and Clean Energy Target (CET)*

*Low Emissions Technology Demonstration Fund*

*Renewable Energy Equity Fund (REEF)*

*Bilateral Climate Action Initiatives (CAP)*

***Overview of policies and measures***

In Australia, the ratio GERD (Gross Domestic Expenditures on Research and Development) over GDP has increased steadily from 1.5 in 1998/99 to 1.76% in 2004/05. As a comparison, this is roughly half the 3 percent target set for European countries by the Lisbon strategy. GERD in Australia reached AUS\$16 billion in 2004-05.

The major sources of funds for R&D in 2004-05 were Business (52%) and the Commonwealth government (36%). Policy and funding are not centralised, but depend on Departments and agencies needs, and on States objectives and demands<sup>15</sup>.

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<sup>15</sup> <http://cordis.europa.eu/erawatch/index.cfm?fuseaction=ri.content&countryCode=AU&topicID=373&parentID=4>

## Appendices

### Summary table

Actions	Initiatives
Research and Development	Backing Australia's Ability
Performance Targets	Mandatory Renewable Energy Target Building Code Australia (BCA) Australian Building Greenhouse Rating (ABGR) scheme National Average Fuel Consumption (NAFC) target Greenlight Australia Green Power Scheme Standards for Energy Efficiency of Electric Motor Systems (SEEEM) Generator Efficiency Standards Energy Rating Label and Minimum Energy Performance Standards Voluntary Building Industry Initiatives Programme Good Environmental Choice Label Fuel consumption label
Mobilisation of Financing	Advanced Electricity Storage Technologies (AEST) Australian Government Water Fund Biofuel Capital Grants Greenhouse Challenge Plus Local Greenhouse Action Low Emissions Technology and Abatement (LETA) Low Emissions Technology Demonstration Fund Measures for a Better Environment (5 programmes) National Plan for Water Security Renewable Energy Development Initiative (REDI) Renewable Energy Industry Development (REID) Renewable Energy Equity Fund (REEF) Solar Cities Wind Forecasting Capability Ethanol Distribution Program Launceston Clean Air Industry Programme Renewable Energy Funding Package for Victoria
Market-based Instruments and State Aid actions	Renewable Energy Certificates (RECs) Solar Hot Water Rebates National Solar School Programme Fuel Tax Reform
Procurement	Commonwealth Fleet Target Australian Green Procurement website ECO-Buy NSW Buy Recycled Alliance Local, national and international policies, regulations and guidelines
Awareness Rising and Training	Energy Allstars Green Vehicle Guide Your Home web site Sustainable House Day Top Energy Saving Award Winner (TESAW) Banksia Eco Innovation Award
Acting Globally	Bilateral Climate Action Initiatives (CAP) Invest Australia
Others	Emission Trading Legislation related to renewable energy Ban of Incandescent Lightbulbs Ten-year Strategy for Fuel Switching to Natural Gas Ethanol Distribution Program

***Eco-industries and innovation***

According to the Australian Bureau of Statistics (ABS), the size of the environment industry in 1999-2000 was about AUS\$16,700 million, of which almost AUS\$1,500 millions coming from cleaner/more efficient technologies and products (see Table 1 below).

**Table 1. Estimated distribution of Australian environment industry activities**

1999-2000, AUS\$m

Environment Industry activities	Production of equipment & materials	Provision of services	Construction & installation of facilities	Total
Pollution Management - of which	3,157	8,168	2,896	14,221
Air pollution control	20	51	18	89
Water & Wastewater management (a)	1,462	3,783	1,341	6,587
Solid waste management	724	1,874	664	3,262
Remediation/Clean-up of soil & water	220	568	201	989
Other services	288	745	264	1,297
Other (Biodiversity & Landscape)	443	1,147	407	1,997
Cleaner & More Efficient Technologies & Products	1 163	0	297	1,461
Resource Management (b)	719	97	208	1,024
<b>TOTAL</b>	<b>5 039</b>	<b>8 264</b>	<b>3 402</b>	<b>16,706</b>

Notes: Based on growth from 1995-96 to 1996-97

(a) Combined water supply and wastewater management

(b) Includes renewable energy industry only.

Source : Compiled from **ABS** 4603.0 and other sources. CSES analysis (from <http://www.environment.gov.au/soe/2006/publications/emerging/industry/index.html> )

**References**

Direct links related to each initiative and programmes are noted in the text. Additional sources of information and contact details are listed below:

European Commission, 2006: *ERAWATCH Research Inventory Report for Australia*

<http://cordis.europa.eu/erawatch/index.cfm?fuseaction=ri.content&countryCode=AU&topicID=373&parentID=4>

Australian Government, 2004: Energy White Paper *Securing Australia's Energy Future*.

[http://www.dpmc.gov.au/publications/energy\\_future/index.htm](http://www.dpmc.gov.au/publications/energy_future/index.htm)

Good Environmental Choice Australia, 2004: *the State of Green Procurement in Australia*.

<http://www.geca.org.au/green-procurement/publications/2004%20STATE%20OF%20GREEN%20PROCUREMENT%20IN%20AUSTRALIA%20REPORT.pdf>

## COUNTRY PROFILE OF CANADA

### **Introduction and country definitions of eco-innovation**

#### ***Definitions related to eco-innovation used in the Country***

No straightforward definition of eco-innovation has been found in the document reviewed. As defined in Canada's innovation strategy, innovation is the process through which new economic and social benefits are extracted from knowledge (<http://innovation.gc.ca/gol/innovation/site.nsf/en/in04144.html> ). In the national policy on green procurement (<http://www.pwgsc.gc.ca/greening/text/proc/pol-e.html> ), environmentally preferable goods and services are defined as those that have a lesser or reduced impact on the environment over the life cycle of the good or service, when compared with competing goods or services serving the same purpose. Environmental performance considerations include, among other things: the reduction of greenhouse gas emissions and air contaminants; improved energy and water efficiency; reduced waste and support reuse and recycling; the use of renewable resources; reduced hazardous waste; and reduced toxic and hazardous substances.

#### ***Institutions playing a major role on eco innovation***

The information following institutions and federal bodies play a major role in policies to support eco-innovation in Canada.

At federal level, the site [Ecoaction](http://www.ecoaction.gc.ca) monitors a number of governmental initiatives related to ecoaction, including ecotechnologies.

#### ***Government of Canada***

The government passes the legislation that sets the requirements (standards, bans, etc.) and targets that create the framework for innovation. This includes, for example, the *Energy Efficiency Act*, and the recently published *Action Plan to Reduce Greenhouse Gases and Air Pollution*.

See <http://www.ecoaction.gc.ca/index-eng.cfm>

#### ***Natural Resources Canada***

Natural Resources Canada is the government department which deals with the natural resources sector, forests, energy, minerals and metals, and landmass, as well as related industries. Some of its departments and agencies lead several initiatives in the field of environmental innovation, like the Energy Efficiency Office (EEO), the Office for Energy Research and Development (OERD) and the CANMET Energy Technology Centre (CETC) ([www.nrcan-rncan.gc.ca/com](http://www.nrcan-rncan.gc.ca/com)).

The Department controls three national laboratories doing research on energy efficiency and emission reductions, for GHG and other contaminants. It implements programmes and provides direct grants for R&D. It works with other departments (Environment Canada, Industry Canada, etc.), whose role is more to set a framework and to highlight issues which need to be addressed. Because a large

majority of GHG emissions is energy-related, Natural Resources Canada's platform and machinery plays a central role; but programmes are managed at intergovernmental level.

The Department works with the provincial governments to identify shared priorities in the energy field. The lack of finance prevents this collaboration from being very concrete.

#### *Environment Canada*

Environment Canada is the government department headed by the Minister of the Environment. Among its tasks, it supports the development and transfer of technologies that contribute to its mandate of environmental protection. It also helps private-sector partners bring green technologies to the marketplace. A lot of science and technology supported by Environment Canada is in support of policy and regulatory development.

#### *Industry Canada*

Industry Canada is the government department in charge of industry and research. Industry Canada is in charge of the so-called Industry Portfolio, a number of agencies that work with industry and research-related issues. Its focus is on competitiveness and productivity, and Industry Canada sets the appropriate framework. As regards science and technology, it has designed the Science and Technology Strategy; environment and energy are among the four priority areas (along with health and life sciences, and with ICT); the Strategy serves as a reference to identify priority investments (and make proposals to the Ministry of Finance) and to facilitate a coordinated Federal approach with other departments who fund science and technology. As regards eco-innovation, Industry Canada focuses on deployment.

#### *Transport Canada*

Transport Canada is responsible for transport policies, regulations and services. Transport Canada, as other departments, is responding to the 'innovation challenge', and is responsible, *inter alia*, for *ecoTRANSPORT*.

See <http://www.tc.gc.ca/programs/environment/ecotransport/menu.htm>

#### *Foreign Affairs and International Trade Canada*

The department hosts the Clean Development Mechanism and Joint Implementation Office, which is the designated national authority for approving emission reduction projects with international partners.

#### *National Research Council Canada*

The National Research Council (NRC) is the governmental agency for research and development. It is located in every province in Canada and plays a major role in stimulating community-based innovation. The NRC is composed of over 20 institutes and national programs, including the Institute for Fuel Cell Innovation.

#### *Canadian Environmental Technology Advancement Centres– CETAC*

([www.oceta.on.ca](http://www.oceta.on.ca))

Three CETACs have been established by the federal government across the country to strengthen and grow the environmental industry: OCETA in Ontario, CETAC-West in Alberta and Enviro-Access in Quebec. They are private, not-for-profit companies. Their respective websites are [www.oceta.on.ca](http://www.oceta.on.ca), [www.cetacwest.com](http://www.cetacwest.com), [www.enviroaccess.ca/](http://www.enviroaccess.ca/). Their mandate is to provide business services to small and medium sized enterprises (SMEs) that are commercializing new technologies in the environment and energy sectors. These organisations work with Industry Canada. Environment Canada sits at the table but is not leading.

#### *Sustainable Development Technology Canada (SDTC)*

SDTC is a not-for-profit foundation, established by the Canadian Government in 2001, which finances and supports the development and demonstration of clean technologies providing solutions to issues of climate change, clean air, water quality and soil (<http://www.sdte.ca/>). SDTC reports to Natural Resources Canada and Environment Canada; Agriculture Canada is now joining, because of biofuel issues; other departments may be invited for discussions on policies and agreements.

SDTC aims at creating an end-to-end cohesive innovation chain, from science to commercialisation, and at bridging the funding and cultural gap that prevents new ideas from reaching a market. It is located outside of government and staffed with people who have both a private sector focus and a public good approach.

SDTC manages to broad funds (see below).

- The sustainable development technology fund (550 million CAN\$) is earmarked for climate change and clean air and soil and finances technologies in the area of oil and gas, and hydrogen;
- The Next Generation Biofuel Fund (500 million CAN\$).

SDTC reports on the environmental benefits of its action; the organisation has a sunset clause. Project owners report on the unit emission improvement, on the actual impacts of the project; they report on market impacts three years after completion of the project. This helps appreciate the potential economic uptake. This also can inform policy makers, on the barriers to deployment and the actions to be taken.

SDTC also provides the government with policy inputs. A particular instrument developed by SDTC is the SD Business Case<sup>TM</sup>, a method to report on primary hurdles to market uptake and on the rationale on how to focus investment in a particular market sector. SDTC draws upon these analyses to inform discussions with governments on opportunities to enhance market uptake driven by smart regulation, for instance in the renewables area (a tax policy to accelerate depreciation) or in biofuels (promoting the next generation feedstock).

SDTC has a catalysing effect: it brings confidence and raises comfort level of clients. All money is grant money, aligned with the development of the project, which can be used to flatten the risk profile of the project.

#### *National Round Table on the Environment and the Economy*

The National Round Table on the Environment and the Economy (NRTEE) is a governmental body born in 1988 dedicated to exploring new opportunities to integrate environmental conservation and economic development ([www.nrtee-trnee.ca/](http://www.nrtee-trnee.ca/)).

*Non-governmental players*

Innovation is also encouraged by the private sector and collaborations between the private sector and the government, also with links to universities, exist.

For instance, a list of public and private organisations dealing with the development and/or the promotion of clean energy technologies can be found at [http://www.cleanenergy.gc.ca/canada/items\\_list\\_e.asp?mode=org](http://www.cleanenergy.gc.ca/canada/items_list_e.asp?mode=org).

One useful document is the *Innovation Map: Associations leading innovation in Canada*.

***Policy documents related to eco-innovation***

Among the main policy documents related to innovations and eco-innovation in Canada, the following have been encountered in the development of this study.

*Canada's Innovation Strategy*

The policy was launched in February 2002, with the release of two documents: *Achieving Excellence: Investing in People, Knowledge and Opportunity* and *Knowledge Matters: Skills and Learning for Canadians*. The papers highlight goals, milestones and targets to improve innovation, skills and learning. The goals are to boost the economy by nurturing a more knowledge-based workforce, and to build a strong scientific and research environment by 2010.

<http://www.innovationstrategy.gc.ca/gol/innovation/site.nsf/en/in04135.html>

*Advantage Canada: Building a Strong Economy for Canadians*

This long-term economic plan by Department of Finance (2006) recognizes that more can be done to turn ideas into innovations that provide solutions to environmental, health, and other important social challenges.

<http://www.fin.gc.ca/ec2006/plan/pltoce.html>

*Mobilizing Science and Technology to Canada's Advantage*

This strategy by Industry Canada (2007) sets out a multi-year science and technology agenda. It is the government's plan to achieve the goals set by *Advantage Canada* (see above). Its ambition is to create three advantages for the Canadians: entrepreneurial advantage, knowledge advantage, people advantage. The strategy focuses, among other areas, on environmental science and technologies, natural resources and energy.

[http://www.ic.gc.ca/epic/site/ic1.nsf/en/h\\_00231e.html](http://www.ic.gc.ca/epic/site/ic1.nsf/en/h_00231e.html)

It claims that strong and clear environmental laws and regulations that work with market forces will create the conditions for businesses and people to respond to environmental challenges with entrepreneurial innovation: such a framework can attract “new economy” firms and entrepreneurs and incubate environmental-protection industries. This includes the Regulatory Framework for Air Emissions (the plan sets mandatory reduction targets for major industries that produce GHGs and selected air pollutants; companies will be able to choose the most cost-effective way to meet them) and the Comprehensive Chemicals Management Plan.

It sets the role of government: to provide an enabling environment that promotes private investment in R&D, advanced technologies and skilled workers. It creates the EcoTrust for Clean Air and Climate Change to support projects in the provinces and the territories that reduce GHG emissions and air pollution; the government will invest over 1.5 billion CAN\$ in the trust.

#### *Policy on Green Procurement*

See below for insights (<http://www.pwgsc.gc.ca/greening/text/proc/pol-e.html>).

Each federal department also periodically publishes its own *Sustainable Development Strategy*, in which sustainable development objectives and action plans are identified. Some of these mention environmental friendly technologies and initiatives. In 1995 'A Guide to Green Government' was released, as a framework to guide federal departments in the preparation of their sustainable development strategies.

#### **Policies, Initiatives and instruments – a national inventory**

This chapter summarises the main initiatives undertaken in Canada to foster environmental innovation, according to the information available in governmental and other official web sites, and to a series of interviews in Ottawa. The selection focused on those initiatives that clearly support eco-innovation. There may well be other initiatives that focus on innovation more broadly or other on achieving other policy objectives that also have an influence on eco-innovation. For the sake of brevity, this country profile focuses on the initiatives more directly supporting eco-innovation.

Whenever possible the achievements obtained by projects and initiatives have been noted. All currencies are in Canadian Dollars.

#### ***Research and Development***

Several funds and initiatives have been established to promote the Research and Development (R&D) phase of new environmental technologies.

The Technology and Innovation Research and Development (T&I R&D) Initiative, which was terminated in March 2008, illustrates the rationale beyond most of these initiatives. T&I R&D was established in 2003 to advance promising greenhouse gas (GHG) technologies through R&D. The T&I R&D budget was \$115 million over five years, to March 2008.

The Office of Energy Research and Development provided T&I R&D funds directly to partner departments and agencies, which then teamed up with provinces, the private sector and/or universities. To achieve significant GHG reductions in the near term, T&I R&D aimed to ensure that clean technology options which provide incremental advances are brought into the energy economy as quickly as possible, e.g. vehicles with reduced fuel consumption, energy-efficient buildings.

In a complementary vein, the Industry Energy Research and Development (IERD) Program, run by the Canmet Energy Technology Centre (CETC), provided refundable funding assistance to the industrial sector – from small to large enterprises. It supported the development and use of new energy-efficient processes, products, systems and equipment proposed by industry. The program forged links between technology developers and end-users to encourage the widest possible application of technologies. The program is currently being wound down.

Canada has historically been very good at spending public money for R&D. One feature of the Science and Technology Strategy nowadays is to increase private sector participation.

A significant part of the projects presented here is funded by other departments/agencies than Environment Canada or Industry Canada. Ten years ago, these departments could hand out money to develop an idea further: these programmes tend to disappear; they are substituted by such tools as SDTC. These departments typically try to work with others, bringing their policy framework to the table. Natural Resources Canada notes that long-term funding decreases (PERD is its main long term programme; see below) and that funding only stabilises because medium-term funds are available (for a period of 4-5 years), which is an issue for some long term research projects.

Natural Resources Canada has a number of procedures to identify and select technologies to be funded. There are a number of panels, where ministers look for advice and recommendations (e.g. the National Advisory Panel on Sustainable Energy Science and Technology, which reported on technological areas where Canada should focus its investments and on approaches the government might use; the 2006 reports focuses on how best to encourage the development and support the widespread commercial deployment of transformative technologies; see NAPSEST, 2006); the Prime Minister recommends that these panels should have a stronger international scope or coverage. The Ministry also surveys regulations in leading countries, to see where they put their money, why and where Canada stands.

#### *Sustainable Development Technology Canada*

SDTC manages to broad funds.

- The Sustainable Development Technology Fund (550 million CAN\$) was established to bridge the gap in the innovation chain by fast-tracking groundbreaking clean technologies through development and demonstration, in preparation for commercialization, encouraging innovation and collaboration among private, academic and public-sector partners. The Fund is earmarked for climate change and clean air and soil and finances technologies in the area of oil and gas, and hydrogen;
- The Next Generation Biofuel Fund (500 million CAN\$) was launched in September 2007, to take advantage of the abundance of suitable biomass materials available in Canada by funding large-scale demonstration facilities and encouraging the growth and retention of home-grown technologies and expertise in Canada.

See: [www.sdte.ca/en/about/index.htm](http://www.sdte.ca/en/about/index.htm)

*Achievements:* To date, SDTC has approved funding for a total of 144 projects, totalling 342 million CAN\$.

#### *Program of Energy Research and Development*

The Program of Energy Research and Development (PERD) is a federal, interdepartmental program operated by Natural Resources Canada. It provides funds directly to 13 partner departments and agencies to support early-stage and applied energy R&D in six technology areas: cleaner fossil fuels; cleaner transportation; energy-efficient buildings and communities; energy-efficient industry; power generation; and Generation IV nuclear technologies. The Office of Energy research and Development provides PERD funds directly to partner departments and agencies, which then team up with all kinds of agents (public or private).

Among its initiatives, PERD - in partnership with TEAM (see below) - funds the Bioenergy Development Program<sup>16</sup> to assist industry R&D and commercialization of bioenergy technologies (see: <http://www2.nrcan.gc.ca/ES/OERD/english/View.asp?x=1317>).

*Achievements:* The fund size is of \$55.3 million per year. PERD currently funds 24 energy R&D programs.

#### *ecoENERGY Technology Initiative*

The ecoENERGY Technology Initiative (EcoETI) is an initiative of Natural Resources Canada and Environment Canada launched in January 2007 and consisting of a \$230 million investment in clean energy science and technology. The initiative funds research, development and demonstration (RD&D) to support the development of next- generation energy technologies needed to break through to emissions-free fossil fuel production (e.g. clean coal, carbon sequestration, technologies reducing the environmental impacts of oil sands, hydrogen and fuel cells), as well as for producing energy from other clean sources, such as renewables (wind, solar, tidal) and bio-energy. The Initiative also supports the use and integration of clean energy in end-use sectors such as buildings and community systems.

See: <http://www2.nrcan.gc.ca/ES/OERD/english/View.asp?x=1603>

#### *Other programmes*

Other programmes need to be mentioned, although they do not specifically focus on environment-related R&D. they include:

- Industrial Research Assistance Program (IRAP) is a long standing program run by the National Research Council. It provides a range of both technical and business oriented advisory services along with potential financial support to growth-oriented Canadian small - and medium-sized enterprises. Website is [www.irap.nrc.gc.ca](http://www.irap.nrc.gc.ca);
- National Science & Engineering Research Council of Canada (NSERC) has a number of different funding programs that mainly support academic research in universities. More information is available at [www.nserc.gc.ca](http://www.nserc.gc.ca).

#### *Sector- or province-specific initiatives*

The Federal state engages in working groups to identify shared priorities with provinces, in the energy sector. The lack of funding prevents this endeavour from bearing concrete results yet.

Some programmes are province-specific (e.g. Atlantic Canada), others focus on one particular industry (e.g. sustainable buildings).

#### *Atlantic Innovation Fund*

The Atlantic Innovation Fund (AIF), run by the Atlantic Canada Opportunities Agency, is a \$300-million, five-year program designed to strengthen the economy of Atlantic Canada by accelerating the development of knowledge-based industry. It supports a wide range of R&D projects, including initiatives related to environmental technologies.

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<sup>16</sup> [http://www.nrcan.gc.ca/es/etb/cetc/cetc01/htmldocs/Groups/Funding%20Programs/fundprog\\_bioenergy\\_e.htm](http://www.nrcan.gc.ca/es/etb/cetc/cetc01/htmldocs/Groups/Funding%20Programs/fundprog_bioenergy_e.htm)

See: [www.acoa.ca/e/financial/aif/index.shtml](http://www.acoa.ca/e/financial/aif/index.shtml)

#### Sustainable Buildings and Communities

The Sustainable Buildings and Communities (SBC) is a governmental group, under Natural Resources Canada, which performs building simulation research and development (R&D) to support the development of software for the building industry and to support government programmes; to assess the performance of emerging energy technologies; and to assist manufacturers of energy technologies with the optimization, integration and speed-to-market of their innovations.

See: [http://www.sbc-bcd.nrcan-rncan.gc.ca/home\\_e.asp](http://www.sbc-bcd.nrcan-rncan.gc.ca/home_e.asp)

#### Industrial Systems Optimization

R&D activities undertaken by the Industrial Systems Optimization team, under Natural Resources Canada, aim at developing methods and tools that optimise industrial processes. This includes enhancing the energy performance of existing equipment, such as dryers, or the optimization of energy and water consumption over an entire industrial site.

See: [http://cetc-varenes.nrcan.gc.ca/en/indus/pp/s\\_s/rd.html](http://cetc-varenes.nrcan.gc.ca/en/indus/pp/s_s/rd.html)

#### *Technology specific programmes*

A number of programmes focus on climate change and/or carbon-related technologies.

#### Technology Early Action Measures

Technology Early Action Measures (TEAM) is an interdepartmental technology investment program. It brings together partners from all levels of government, industry, and communities to support late stage development and first demonstration of greenhouse gas (GHG) reducing technologies – namely cleaner fossil fuels, energy-efficiency technology, biotechnology, hydrogen economy and decentralized energy production. Industry, Energy and Environment Canada sit at the board where proposals are put forward; they all bring their own perspective.

TEAM is committed to reporting on the performance of each project it funds and the impacts these projects have on reducing GHG emissions. To help in meeting this commitment, a method of evaluating GHG emission reductions as been developed: the System of Measurement and Reporting for Technologies (SMART). Up to \$40,000 per project is allocated towards applying SMART.

See: <http://www.team.gc.ca/>

*Achievements:* Up to 2005, TEAM financed 106 projects worth a total of 1,017 m\$. In December 2000, TEAM received the ‘Head of the Public Sector Award’ for its ‘excellence in policy’. TEAM is winding down and is being merged into the EcoEnergy Technology Initiative (Eco-ETI) Programme (see above).

#### The Canadian CO<sub>2</sub> Capture and Storage Technology Network (CCCSTN)

The CCCSTN under Natural Resources Canada provides information for the coordination of research, development and deployment efforts of national carbon capture and storage (CCS) initiatives as well as timely information on technology advancements. On its web site it is possible to find a

network of experts, current project information and links to other related information which aim to accelerate the development and deployment of CCS.

See: <http://www.nrcan.gc.ca/es/etb/cetc/combustion/co2network/>

#### Institute for Fuel Cell Innovation R&D Program

The institute, which is part of the National Research Council, manages a program aimed at advancing fuel cell science and technology and accelerating the commercialization of these technologies through collaborative R&D, licensing and the creation of new enterprises. The program is applied to four strategic areas: Polymer Electrolyte Membrane Fuel Cells, Solid Oxide Fuel Cells (SOFC), Hydrogen and Alternative Fuels and Integrated Energy Systems Demonstrations.

See: [http://ifci-iipc.nrc-cnrc.gc.ca/main\\_e.html](http://ifci-iipc.nrc-cnrc.gc.ca/main_e.html)

#### ***Verification of technologies***

##### *Environmental Technology Verification (ETV) Programme*

The ETV Programme is Canada's verification programme for environmental technologies. It is run by ETV Canada, a private sector company that operates under a licence agreement with Environment Canada. ETV verifies the environmental performance claims associated with projects and programs, as well as technologies and technological processes. In that context, verification provides the marketplace with the assurance that environmental performance claims are valid, credible and supported by quality independent test data and information.

In Canada, ETV is considered as a decision support tool for the government (contributing to Environment Canada's regulatory agenda, by ensuring that reliable data on the environmental performance of technologies is available), as a benchmarking tool for regulated industry and a marketing tool for environment industry (technology developers).

ETV Canada reports some 60 certificates had been awarded by the end of 2007, some 30 to 40 test plans have been developed.

A technology verification tool (SMART) has also been developed in the context of the Technology Early Action Measures (TEAM) investment program.

See: <http://www.etvcanada.ca/>

##### *Community Energy Systems Program*

The Community Energy Systems Program (CES), under Natural Resources Canada, identifies and develops opportunities for Canadian communities to use district heating and cooling, combined heat and power (co-generation), waste heat recovery, thermal storage, and local sources of renewable energy, particularly biomass. CES operates a laboratory to test and develop district energy technologies.

See: <http://www.cetc.nrcan.gc.ca>

### ***Performance Targets***

Some performance targets have been developed under the Energy Efficiency Act and the R-2000 Standard.

#### *The Energy Efficiency Act (EEA)*

The federal EEA (set in 1995) includes standards for energy efficiency for a range of products. Upcoming amendments will either set a minimum energy performance standard for a series of new products or will make existing standards more stringent for others. The amendments will come into force between 2007 and 2010.

***Achievements:*** Broadening and strengthening the Act means that 80 percent of the energy used in homes and businesses will soon be regulated. Over time, the set of planned new regulations will address about 20 currently unregulated products, and will tighten requirements for 10 products.

See [http://www.nrcan-rncan.gc.ca/media/newsreleases/2007/200704b\\_e.htm](http://www.nrcan-rncan.gc.ca/media/newsreleases/2007/200704b_e.htm)

#### *R-2000 Standard*

Developed in partnership with Canada's residential construction industry, R-2000 is an initiative of the Natural Resources Office of Energy Efficiency. It aims to promote the use of cost-effective energy-efficient building practices and technologies. The R-2000 Standard is based on an energy consumption target for each house and a series of technical requirements for ventilation, air tightness, insulation, choice of materials, water use and other issues. The requirements are about 40 percent better than existing building codes. The result is new houses that use at least 30 percent less energy than conventional new houses.

See: <http://oee.nrcan.gc.ca/residential/personal/new-homes/r-2000/About-r-2000.cfm?attr=4>

***Achievements:*** Since its introduction, over 20 years ago, close to 900 builders have been licensed to build R-2000 homes, and more than ten thousands R-2000 homes have been built and certified.

### ***Mobilisation of Financing***

The Canadian private sector is reluctant to invest in R&D. SDTC and tax incentives are meant to engage the private sector in funding R&D (e.g. Scientific Research and Experimental Development Program, which provides tax incentives to support industrial scientific research and experimental development in Canada).

A number of funds and programmes exist to stimulate private investment in eco-innovation. A significant portion is focused on clean energy. Other instruments aim at facilitating application in particular industries (transport and freight, building and construction...).

#### *Clean-energy related funds*

Industry can submit proposals under two new funds:

- A \$125 million fund to advance carbon capture and storage technologies that will reduce greenhouse gas emissions from the oil sands and coal-fired electricity plants;

- A \$15 million fund to advance the development of technologies that will reduce the environmental impacts of oil sands production, such as tailings ponds.

Similarly, the Renewable Energy Technologies Program (RETP), run by the CANMET Energy Technology Centre of Ottawa (CETC), supports the improvement of the economics and efficiency of renewable energy technologies. Technologies include: bioenergy (combustion, biochemical conversion of biomass to ethanol, thermochemical conversion of biomass to bio-oil and biogas, and biomass preparation and handling); small hydro projects (less than 20 megawatts); active solar applications; and wind energy. See: [www.cetc.nrcan.gc.ca](http://www.cetc.nrcan.gc.ca) and <http://www2.nrcan.gc.ca/ES/OERD/english/view.asp?x=1563>.

#### *Emerging Technologies Program*

The Emerging technologies Programme (ETP), run by the Canmet Energy Technology Centre (CETC), identifies technical barriers to increasing the energy efficiency of Canadian industries by providing up to fifty per cent funding assistance. ETP supports the development and implementation of technological solutions that contribute to a cleaner environment, improved energy efficiency and productivity, higher quality products, reduced waste, and a stronger market position for Canadian companies.

Clients to-date include the pulp and paper, iron and steel, cement, oil and gas, and food and beverage sectors. All industrial sectors are eligible.

#### *Buildings Energy Technology Program*

The Buildings Energy Technology Program (BET), run by the Office for Energy Research and Development (OERD) accelerates the development and use of energy-efficient residential and commercial building technologies, from R&D and field trials through to technology transfer and commercialization. Working domestically and internationally with associations, governments and industry, the program funds projects that involve research and development, dissemination and deployment related to building technologies and tools that increase energy efficiency, lessen environmental impacts and are replicable to the housing and commercial building industry. Total funding varies from \$150,000 to \$300,000 per fiscal year.

See: <http://www2.nrcan.gc.ca/ES/OERD/english/view.asp?x=1548>

#### *Transportation related programmes*

The Hydrogen, Fuel Cells and Transportation Energy program (HyFate), run by the CANMET Energy Technology Centre of Ottawa (CETC), works in partnership with industry to develop and deploy leading-edge transportation technologies that minimize environmental impacts, such as: alternative fuels and advanced propulsion systems; advanced energy storage systems; emissions control technologies; vehicle transportation systems efficiency; and fuelling infrastructures.

See: [http://www.nrcan.gc.ca/es/etb/cetc/cetc01/htmldocs/Groups/hyfate\\_e.htm](http://www.nrcan.gc.ca/es/etb/cetc/cetc01/htmldocs/Groups/hyfate_e.htm)

The Canadian Transportation Fuel Cell Alliance (CTFCA), managed by Natural Resources Canada, is a \$33 million, seven-year demonstration program for hydrogen infrastructure. Partners include technology developers, fuel providers, auto manufacturers, federal and provincial governments, academia and non-governmental organizations. The CTFCA demonstrates and evaluates the technical feasibility as well as the economic and emissions implications of hydrogen refuelling

options for fuel cell vehicles. The initiative also establishes a supporting framework for hydrogen refuelling by assisting in the development of codes and standards as well as certification and training programs.

See: <http://www.nrcan.gc.ca/es/etb/ctfca/index.html>

The ecoFREIGHT program, under Transport Canada, aims to reduce the environmental and health effects of freight transportation through the use of technology. It consists of two programmes:

- *The Freight Technology Demonstration Fund* - which provides the freight transportation industry with cost-shared funding for real world testing of freight transportation technologies that have the potential to reduce the emissions of air pollutants and greenhouse gases.
- *The Freight Technology Incentive Program* – which provides cost-shared funding to companies and non-profit organizations in freight transportation to help them purchase and install proven emission-reducing technologies.

See: <http://www.tc.gc.ca/programs/environment/ecofreight/menu-eng.htm>

### ***Market-based Instruments***

One illustration of market based instruments is the 1.5 billion CAN\$ budget the Government has committed toward putting emission-free energy on the grid. MBIs of relevance to eco-innovation in Canada include:

- Wind Power Production Incentive
- Quebec royalty system
- Pilot Emission Removals, Reductions and Learnings
- Emissions trading
- ecoAUTO Rebate Program
- Green budget and subsidy reform

#### *Wind Power Production Incentive*

This is a federal initiative launched in 2001 and consisting of a production incentive for electricity from wind turbines. An initial incentive payment of 1.2¢/kWh of production, gradually declining to 0.8¢/kWh, was introduced for qualifying projects commissioned between April 2002 and 2007. The total budget is \$260 million<sup>17</sup>. The commitment of funds for wind energy projects under the WPPI program ended on March 31, 2007.

See: <http://www.canren.gc.ca/programs/index.asp?CaId=107>

#### *Pilot Emission Removals, Reductions and Learnings (PERRL)*

Through PERRL, the federal government buys the rights to verified greenhouse gas emission reductions from eligible projects for a fixed price per tonne. The total budget is \$15 million. The initiative was launched in 2002 and terminated in December 2007.

<sup>17</sup> Source: <http://www.fiscallygreen.ca/>

See: [http://www.ec.gc.ca/perrl/home\\_e.html](http://www.ec.gc.ca/perrl/home_e.html)

*Achievements:* PERRL's first auction round resulted in signed purchase contracts for 899,606 tonnes of greenhouse gas emission reductions at an average price of \$3.33/tonne from four landfill gas projects<sup>17</sup>.

#### *ecoAUTO Rebate Program*

The ecoAUTO Rebate Program, under Transport Canada, encourages consumers to buy fuel-efficient vehicles by offering rebates from \$1000 to \$2000, to people who, beginning March 20, 2007, buy a fuel-efficient vehicle. \$160 million over two years have been allocated to offer performance-based rebates on new light duty vehicles.

See: <http://www.tc.gc.ca/programs/environment/ecotransport/ecoauto.htm>

#### *Quebec royalty system*

The province is introducing a hydrocarbon royalty (or carbon levy) that will be applied to all greenhouse-gas-emitting businesses in the energy sector. The amount of the royalties will be calculated on the basis of the level of carbon dioxide equivalent emissions from each form of energy. The revenues will be channelled into a Green Fund, estimated to consist of \$200 million per year, to finance climate change actions. The ambition is to reduce greenhouse gases in Quebec by 10 million tons a year by 2012<sup>18</sup>.

#### *Emissions trading*

Ontario has introduced a cap and trade system for emissions of nitrogen oxides and sulphur dioxide from power plants. The federal government is considering to develop a domestic inter-firm trading system.

The Montreal Climate Exchange, the first environmental products financial market in Canada, was also set up in 2006.

#### ***Green Procurement***

Initiatives related to green procurement are taken at both federal and regional/provincial levels.

A new green procurement policy came into effect in April 2006. It focuses on the integration of environmental performance considerations into the procurement decision-making process including planning, acquisition, use and disposal. It does allow green procurement targets to be set as appropriate. There are guidelines and tools (e.g. environmental awareness tool kit for green procurement) available to help take procurement decisions and help set green procurement targets. A range of organisations are supporting the development of green procurement, including the Office of Greening Government Operations (OGGO), Environment Canada and Natural Resources Canada. OGGO was created in 2005 within Public Works and Government Services Canada, to accelerate the greening of the government's operations; it works closely with other federal departments, particularly the Treasury Board Secretariat and Environment Canada.

See <http://www.pwgsc.gc.ca/greening/text/proc/pol-e.html>

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<sup>18</sup> See also [http://www.kyotosmart.net/pdf/case\\_quebec.pdf](http://www.kyotosmart.net/pdf/case_quebec.pdf)

***Awareness raising and training***

Initiatives include:

- Advanced Technology Vehicles Program
- ecoTECHNOLOGY for Vehicles
- ecoENERGY Efficiency
- Freight Efficiency & Technology Initiative
- Fuel Consumption Program
- Environmental Choice Program
- RETScreen
- EnerGuide Program
- Clean energy portal
- Events and Trade fairs

***ecoTECHNOLOGY for Vehicles***

The Government of Canada has launched the ecoTECHNOLOGY for Vehicles Program to help Canadians make informed choices when purchasing a vehicle. The program includes in-depth testing and publishing of the safety and environmental performance of a range of emerging technologies for use in light-duty vehicles. The program showcases green technologies at auto shows across the country, provides consumers with information, fosters partnerships with the automobile industry across the country to help identify and take action on barriers to the introduction of environmental technologies.

See: <http://www.tc.gc.ca/programs/environment/etv/menu-eng.htm>

***ecoENERGY Efficiency***

Through the ecoENERGY Efficiency Initiative, the Office of Energy Efficiency (OEE) works to improve energy conservation and energy efficiency in every sector of the economy. The OEE offers grants and incentives and other resources, including workshops for professionals, statistics and analysis, awards and free publications. The initiative includes several programs, namely:

- ecoENERGY for Buildings and Houses: provides publications, training, tools and other technical information to help choose energy efficiency measures and practices for buildings; standards and rating systems have also been developed;
- ecoENERGY for Industry: assesses companies' capacity to reduce energy use; trains managers in energy efficiency and conservation; identifies least-cost options for reducing companies emissions and; provides a forum for sharing information on new technologies and best practices;
- ecoENERGY for Personal Vehicles: provides motorists with tips on buying, driving and maintaining their vehicles to reduce fuel consumption and GHG emissions;
- ecoENERGY for Fleets: emphasize information-sharing, workshops and training to help fleets increase their fuel efficiency;

- Transportation: programs to encourage manufacturers voluntary initiatives on fuel efficiency (Vehicle Efficiency), increase efficiency of federal fleets (Federal Vehicles) and inform the public about alternative fuels (Alternative Fuels)

#### *Freight Efficiency & Technology Initiative*

The Freight Efficiency and Technology Initiative is a five-year initiative of Transport Canada designed to reduce the growth of greenhouse gas (GHG) emissions from freight transportation. It consists of three components:

- the Freight Sustainability Demonstration Program: demonstrating and encouraging the uptake of innovative technologies and efficient best practices within the freight transportation sector
- Voluntary Performance Agreements: soliciting the freight transportation industry's participation in emissions reduction initiatives; and
- Training and Awareness amongst freight operators: increasing fuel efficiency and environmental awareness

See: <http://www.tc.gc.ca/programs/environment/freight/FETI/menu.htm>

*Achievements*: The freight initiative has a budget of \$14 million and is expected to result in approximately 2 mega tonnes of GHG emissions reduction by 2010.

#### *Environmental Choice Program*

The Environmental Choice Program (ECP) is a certification program for “green” products and services run by the company Terra Choice, under a license agreement with Environment Canada. The programme helps consumers identify products and services that are less harmful to the environment. The program awards green products and services with an environmental certification mark (EcoLogo<sup>M</sup>) recognised in North America. A web site provides information on environmentally-responsible products and services and links to companies who participate.

See: [www.ecologo.org/en/](http://www.ecologo.org/en/)

#### *RETSscreen*

The RETScreen International Clean Energy Decision Support Centre, managed by the CANMET Energy Technology Centre, seeks to build the capacity of planners, decision-makers and industry to implement renewable energy and energy efficiency projects. This objective is achieved by: developing decision-making tools (e.g. RETScreen Software) that reduce the cost of pre-feasibility studies; disseminating knowledge to help people make better decisions; and by training people to better analyse the technical and financial viability of possible projects.

See: <http://www.retscreen.net/>

*Achievements:* The RETScreen software has saved \$240 million in Canada and \$600 million \$600 million dollars by 2004, and was used in about 200 countries. The initiative won the Canadian Government's 2001 'Head of the Public Service Award' for excellence in service delivery<sup>19</sup>.

### *EnerGuide Program*

EnerGuide is a Natural Resources Canada initiative that helps consumers purchase the most energy-efficient equipment on the market, in order to increase public awareness of the link between energy and the environment and to promote the opportunities opened up by energy-efficient technology. This on-line tool shows how much energy appliances consume in a year of normal service and makes it easy to compare the energy efficiency of each model to others of the same size and class.

See: <http://oee.nrcan.gc.ca/Equipment/english/index.cfm?PrintView=N&Text=N>

### *Clean energy portal*

Cleanenergy is a web portal providing resources and information about clean energy, i.e. on: contacts details of Canada's clean energy firms, key technologies and government resources central to clean energy and climate change; and Canadian and international climate change initiatives.

### *Events and Trade fairs*

Several trade fairs and events promote environmental innovation and technology in Canada. Among these: Globe (held in Vancouver, BC, on even calendar years; [www.globe.ca](http://www.globe.ca)), Americana (held biannually, in Montreal, Quebec, on odd calendar years; [www.americana.org/](http://www.americana.org/)); both promote environmental innovation, but Globe focuses on the Asian market, whereas Americana looks South (e.g., Mexico, South America).

Other events include: the Green Building Festival Conference ([www.greenbuildingfest.com](http://www.greenbuildingfest.com)), the Cleantech Forum (<http://cleantechnetwork.com/>), the business of Climate Change Conference ([www.thebusinessofclimatechange.com/](http://www.thebusinessofclimatechange.com/)), the CanSIA Solar Conference (<http://www.cansia.ca/conference2007.asp>), the Canadian Waste & Recycling Expo ([www.cwre.ca](http://www.cwre.ca)), etc.

Industry Canada organises a number of workshops across the country, to bring vendors and buyers together.

### *Acting globally*

Canada collaborates with many developed and developing countries to promote research and implement projects on eco-innovation and environmental technologies, and to promote exports of Canadian environmental technologies (via provincial industry associations):

- CDM and JI: There is active work in this area with MOUs (Memorandum of Understanding) completed for a range of countries<sup>20</sup>. Projects have to be approved by Canada's *Clean Development Mechanism and Joint Implementation Office*. Initiatives supported included projects dealing with energy efficiency, landfill gas capture, renewable energy, etc.

<sup>19</sup> <http://www.retscreen.net/ang/impact.php>

<sup>20</sup> With: Poland, Ukraine, Latvia, Korea, Chile, Colombia, Costa Rica, Nicaragua, Tunisia, Uganda. <http://www.nrcan.gc.ca/es/etb/cetc/cep/CDM-JI%20Workshop%20-%20About%20CDMJ%20Office.pdf>

- *Canadian Initiative for International Technology Transfer*: the initiative, under the CANMET Energy Technology Centre (CETC), helped identify and develop climate change technology transfer to both developed and developing countries through Canadian businesses and non-government organizations<sup>21</sup>. It ran from 2002 to 2007;
- *Commission for Environmental Cooperation (CEC)*: it is an international organization created by Canada, Mexico and the United States under the North American Agreement on Environmental Cooperation (NAAEC). The CEC was established to address regional environmental concerns, help prevent potential trade and environmental conflicts, and promote the effective enforcement of environmental law. Among its programs and projects, it helps identify opportunities for cooperation and trade in environmental goods and services including renewable energy and energy efficiency;
- Canada, Mexico and the United States have a long history of bilateral cooperation on energy science and technology. In 2007 the three countries signed a *Trilateral Agreement for Cooperation in Energy Science and Technology* to fuel joint developments to seek cleaner and more efficient ways to use energy<sup>22</sup>.
- The *Asia-Pacific Partnership for Clean Development and Climate* engages in cooperative research and application of technologies.

However, Natural Resources Canada notes that resources are scarce and not earmarked for international cooperation; intellectual property right issues, constraints on international money transfers also hinder international cooperation on R&D and technological issues.

## Country Synthesis

### *Overview of policies and measures*

Canada's Gross Domestic Expenditures on Research and Development (GERD) as a percentage of GDP was 1.89 per cent in 2004, lower than its peak of 2.05 per cent in 2001 though higher than in 1999<sup>23</sup>. This is about one percentage point below the EU target for R&D expenditure set by the EU Lisbon Strategy, namely 3% of GDP by 2010. However, it is higher than the 2002 average GERD in EU15 and previous candidate countries, i.e. 1.76%.

Several initiatives are in place to foster environmental innovation, and technology in particular. These include clear and effective policy frameworks (including on air pollution, GHG emissions and dangerous chemical substances); the EcoEnergy Technology Initiative; and supporting collaborative research initiatives in the provinces and territories.

Most initiatives fund research and development or cradle-to-grave development of new products, in a technology push approach. However, the government is withdrawing from direct R&D spending as this creates issues with WTO, NAFTA... At Industry Canada, the direction is rather towards promoting competitiveness and productivity, by setting up the appropriate framework.

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<sup>21</sup> See <http://www.nrcan.gc.ca/dmo/aeb/aeb-rpts-2006-E05010-e.htm>

<sup>22</sup> See [http://www.nrcan.gc.ca/media/newsreleases/2007/200766a\\_e.htm](http://www.nrcan.gc.ca/media/newsreleases/2007/200766a_e.htm)

<sup>23</sup> See Canada's Performance Report 2005 - Annex 3 - Indicators and Additional Information [http://www.tbs-sct.gc.ca/report/govrev/05/ann301\\_e.asp#a3green](http://www.tbs-sct.gc.ca/report/govrev/05/ann301_e.asp#a3green)

Environment Canada and Industry Canada have instruments to create markets. Now the domestic market may not be large enough to stimulate a response from the industry.

Notable initiatives are the ETV Program (on technology verification), the Energy Efficiency Act (on efficiency targets), and the new federal policy on green procurement. Some market-based instruments promote renewable energy sources and fuel efficient vehicles, while a carbon levy is being applied in Quebec.

### *The role of globalisation*

There is a substantial collaboration of Canada with the US and Mexico in the development of international/ North American initiatives. Commissions and Working Groups, as well as tri-lateral agreements, have been created to discuss and develop cross-border projects, e.g. on environmental performance verification, energy and trade of green products. An eco-label widely recognised in North America has been created (the EcoLogo).

Collaboration in the field of environmental innovation with developing countries and economies in transition has been carried on through CDM and JI and other frameworks, especially on energy efficiency. Canada is also very active in promoting its model for environmental performance verification abroad, including in developing countries such as Bangladesh.

### *Lessons*

- A number of not-for profit organisations have been created by the Canadian Government to deal with environmental technology and innovation – such as the three CETACs and Sustainable Development Technology Canada. This arms-length relationship to government is a feature of the Canadian approach to eco-innovation (and especially of Environment Canada). It should be noted that foundations and CETACs are third-party, arm's-length, not-for-profit organizations and primarily federally funded, the CETACs focus on business services whereas the foundations focus on providing direct funds for research, development and demonstration of new technologies. The funds given to the CETACs on an annual basis are very modest in comparison to the funds that are distributed annually by the foundations for technology innovation projects.
- A large number of funds support the development and deployment of eco-innovation and technology, especially the R&D phase. Some of these initiatives encourage explicitly collaborations between the public and the private sector. Clean energy is one of the areas that receive most of the attention - hydrogen and fuel cells in particular.
- There is a rich articulation between regulation and innovation. At Environment Canada, innovation is geared towards improved regulation and monitoring. At the same time, the Clean Air regulation agenda includes a technology fund: non complying companies pay a penalty to a fund that will support technologies to help compliance.
- Canada has a well established system (ETV) for verifying the environmental performance claims associated with projects and programs, and technologies. ETV also collaborates in the area of verification with the US South Korea and Japan and with a similar initiative in the European Commission.

- Energy performance standards are set by law. The regulation has recently been broadened to cover 80 percent of houses and business energy use. National standards have also been developed for energy efficiency in buildings
- Canada has in place a number of market-based instruments promoting renewable energy, green house gases emissions reduction and fuel efficient vehicles. Quebec also recently implemented a carbon tax. A cap and trade system for NO<sub>x</sub> also exists in Ontario.
- A new green procurement policy has been recently issued in Canada, allowing green procurement targets to be set as appropriate. Guidelines and tools are available to help green procurement decisions.
- Several initiatives (funds, market based instruments and awareness rising) aim to promote cleaner fuels and/or reduced emissions from the transport sector. Some of these are especially targeted to the freight sector.
- Canada, Mexico and the United States have a long history of bilateral cooperation on energy science and technology. Examples of regional collaboration in the field of environment and innovation are the *Commission for Environmental Cooperation* and the *North America Working Group on Environmental Enforcement and Compliance Cooperation*.
- Canada is also involved in a number of projects on environmental cooperation with developing countries – e.g. through CDM mechanism and other projects on energy efficiency.
- The possibility of spill-over effects has been identified and discussed at Federal level. However, to restrict support to eco-innovation which can address domestic environmental issues would restrain the number of projects. Moreover, the general analysis is that the Canadian industry will also benefit from projects and innovations even though foreign suppliers may benefit first (e.g. the pulp and paper industry imports German equipments and machinery, but the improved environmental performance will benefit the Canadian industry as well).
- Environment Canada is looking for indicators to assess the environmental impact of its programmes in favour of green technologies.

## Appendices

### Summary table

Actions	Initiatives
Research and Development	Sustainable Development Technology Fund Technology Early Action Measures Program of Energy Research and Development ecoENERGY Technology Initiative Atlantic Innovation Fund Sustainable Buildings and Communities Industrial Systems Optimisation Canadian CO2 Capture and Storage Technology Network Institute for Fuel Cell Innovation R&D Program Technology and Innovation Research and Development Industry Energy Research and Development Program
Verification of Technology	Environmental Technology Verification (ETV) Program. Community Energy Systems Program
Performance Targets	The Energy Efficiency Act The R2000 Standard The C-2000 Program for Advanced Commercial Buildings
Mobilisation of Financing	Emerging Technologies Program Western Economic Partnership Agreements Buildings Energy Technology Program Renewable Energy Technologies Program Hydrogen, Fuel Cells and Transportation Energy Program Canadian Transportation Fuel Cell Alliance ecoFREIGHT Program
Market-based Instruments and State Aid	Wind Power Production Incentive Pilot Emission Removals, Reductions and Learnings ecoAUTO Rebate Program Quebec royalty system Emissions trading Green budget and subsidy reform
Procurement	Policy on Green Procurement Alberta Ministry of Environment procurements
Awareness Rising and Training	Advanced Technology Vehicles Program ecoTECHNOLOGY for Vehicles ecoENERGY Efficiency Freight Efficiency & Technology Initiative Fuel Consumption Program Environmental Choice Program RETScreen EnerGuide Program Clean energy portal Events and Trade fairs
Acting Globally	Collaboration with Mexico on emissions trading. CDM and JI International projects on clean energy Canadian Initiative for International Technology Transfer: Commission for Environmental Cooperation North America Working Group on Environmental Enforcement and Compliance Cooperation Trilateral Agreement for Cooperation in Energy Science and Technology

### ***Green technologies in Canada***

According to Statistic Canada the Environmental industry consisted of almost 7,500 companies in 2005, employing more than 160,000 people<sup>24</sup>. According to the House of Commons Standing Committee on Industry 2000 report on the Canadian productivity, competitiveness and prosperity, Canada's environment sector employed about 220,000 people in 2000, and was the third largest employment sector in the country<sup>25</sup>.

The supply of environmental goods and services (environmental revenues) was estimated to be worth about \$ 14.4 billion in 2000, (about €10.5 billion) of which 6,2 (€4.6 billion) came from environmental goods, 6,3 (€4.6 billion) from services and 1,9 (€1.4 billion) from environment-related construction<sup>26</sup>. In 2002 revenues from sales of environmental goods and services were \$15.8 billion (about €10.7 billion) and increased to \$18.5 billion (about €11.5 billion) in 2004. In the same year export markets represented 8.1% of environmental revenues in 2004, i.e. \$1.5 billion (about €930 million), with the USA being the largest export market for Canada's environmental industries followed by Europe and Asia<sup>27</sup>. The sectors contributing the most to the overall revenue are shown in the graphic below.

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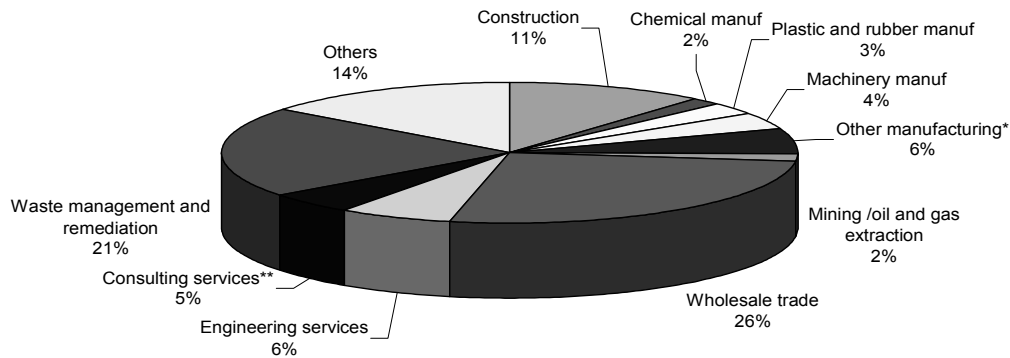
<sup>24</sup> <http://www40.statcan.ca/101/cst01/envi30a.htm>

<sup>25</sup> Source: <http://cmte.parl.gc.ca/Content/HOC/committee/362/indu/reports/rp1031680/indy20/18-ch10-e.html>

<sup>26</sup> Source: <http://www40.statcan.ca/101/cst01/envi30a.htm>

<sup>27</sup> Statistic Canada, 2007

Figure 1. Environmental revenues by sector<sup>28</sup>



\* Other manufacturing including: non metallic mineral product, primary metal, fabricated metal product, computer and electronic products, electrical equipment, appliance and component, and other manufacturing

\*\* Consulting including: environmental, management and other scientific and technical consulting services

Source : adapted from Statistic Canada, 2007

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Statistic Canada, 2007: *Environment Industry: Business Sector - 2002 (revised) and 2004*

National Advisory Panel on Sustainable Energy Science and Technology (2006), *Powerful Connections. Priorities and Directions in Energy Science and technology in Canada*  
[http://www.nrcan.gc.ca/eps/oerd-brde/report-rapport/toc\\_e.htm](http://www.nrcan.gc.ca/eps/oerd-brde/report-rapport/toc_e.htm)

Direct links related to each initiative and programmes are noted in the text.

<sup>28</sup> Note only the sectors above \$ 200 m. Other sectors fall into the category ‘Others’

## COUNTRY PROFILE OF JAPAN

### Introduction and country definitions of eco-innovation

Japan has ambitions to become a *Leading Environmental Nation* as declared in its “Strategy in the 21st Century: Japan's Strategy for a Sustainable Society”. Eco-innovation is at the heart of the strategy<sup>29</sup>. A number of key strategic policy documents explicitly refer to that concept: eco-innovation has been referenced in the Innovation 25 (a Cabinet Decision of June 2007), in the 21 Century Environment Nation Strategy (a Cabinet Decision of June 2007), in the Economic Growth Initiative (as revised in June 2007) and in the Economic and Fiscal Reform 2007 (Basic Policies) (a Cabinet Decision of June 2007). Furthermore, the technological development to address global warming, which forms an important part of eco-innovation, constitutes the basis for the innovative technological development that is included in the Cool Earth 50 proposed by Prime Minister Abe in May 2007 with respect to the challenge of global climate change. The promotion of eco-innovation is a joint responsibility of all the ministries involved.

### *Definitions related to eco-innovation used in the country*

In a document presented at the OECD, METI defines eco-innovation as techno-social innovations to meet environment challenge, resource constraints and diversification of values among the people with compatibility between economy and environment. Concrete measures are taken in Japan to support this type of innovation, at industry level (working towards sustainable manufacturing which utilizes recycling resources and reduces resources), at the level of infrastructures (deployment of zero-emission social infrastructures, e.g. zero-emission-type coal fired power generation with efficient coaling/carbon capture and storage, and distribution and diversification of energy sources using IT technology; environment friendly transport or IT systems; etc.), and involving consumers (realizing sustainable consumption and life-style, for instance by selling functionalities, not goods).

Japan also defined eco-innovation in the “Economic and Fiscal Reform 2007 - Basic Policies” (19<sup>th</sup> June 2007 Cabinet Decision; this is the annual document directing Japan’s whole economic policies) as “the comprehensive initiative for technology development and social reform, using its dominance of high level technologies in *monodzukuri* area and in environment or energy saving as driving force, in order to achieve the sustainable society”; where *monodzukuri* literally means "goods production": it is the art of making things as perfectly and efficiently as possible while respecting nature in terms of both the materials used and the environment; this concept is at the core of the Japanese notion of value creation.

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<sup>29</sup> <http://www.env.go.jp/en/focus/070606.html>; <http://www.env.go.jp/en/focus/attach/070606-a.pdf>;  
<http://www.env.go.jp/en/focus/attach/070606-b.pdf>

***Institutions playing a major role on eco innovation***

The information provided in this report is mainly based on initiatives taken by the following bodies:

- Ministry of the Environment (MOE)
- Ministry of Economy, Trade and Industry METI (formerly, MITI) and its affiliates;
- Ministry of Education, Culture, Sports, Science and Technology (MEXT)
- Ministry of Land, Infrastructure, Transport and Tourism (MLIT)
- The Council for Science and Technology Policy (CSTP)

In Japan, industry (e.g. Nippon Keidanren) is a major contributor to innovation and the report refers to a number of examples of such contribution and commitment.

*Ministry of the Environment*

The government passes the legislation that sets the requirements (standards, bans, etc.) and targets that create the framework for environmental policies. This includes, for example, the Law on Promoting Green Purchasing & Basic Policy on Green Purchasing (2001, in coordination with METI)<sup>30</sup>. MOE hosts the Office of Environmental Research and Technology and oversees the Japanese Environmental Technology Verification program (J-ETV) (see below) (see <http://www.env.go.jp/en/>). It focuses on basic environmental information for policy making, including monitoring data of global warming.

The Ministry of the Environment cooperates on programmes with other institutions (e.g. METI; Ministry of Agriculture, on the production of biofuel from wood).

The Ministry supervises the National Institute for Environmental Studies (NIES). Since its establishment in 1974, the National Institute for Environmental Studies (NIES), independent administrative institution, has been playing a major role in environmental research in Japan. The current five year plan (2006-2010) covers four main areas for research: Climate Change, Sustainable Material Cycles, Environmental Risk, and the Asian Environment where NIES will undertake advanced, farsighted fundamental research. In addition, NIES disseminates a variety of environmental information from both internal and external sources. NIES has a budget of 71 billion Yen for 5 years.

*Ministry of Economy, Trade and Industry, METI (formerly, MITI)*

METI is a key driver for innovation, including eco-innovation in Japan. It considers that eco-innovation will provide a source of international competitiveness not easily emulated by other countries and work as the engine for new economic growth. Simultaneously, a sustainable society where economy is compatible with environment and people will serve as a world model for an innovation-driven sustainable industry and society. This approach is becoming a key to future growth of Japan's economy.

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<sup>30</sup> <http://www.env.go.jp/en/laws/policy/green/index.html>

METI supplies significant research and development (R&D) budgets (leading position relative to other ministries), is working on accelerating patent applications<sup>31</sup>, and works on global mutual respect of intellectual property rights (IPR) – a big issue for Japan.

METI actions focus on encouraging progress towards climate change (in line with the Kyoto protocol target, for a post-2012 framework, R&D for long term target as 50% in 2050), 3Rs (Reduce, Reuse, and Recycle)<sup>32</sup>, promoting environment-friendly management and environment-related business and address hazardous substances. On the legislative side it was behind the “Energy Conservation Law” and the “Law Concerning Special Measures for Promotion of New Energy Use” (New Energy Law, approved in 1997 and revised in 2002) that encourages renewable energies<sup>33</sup>.

Furthermore, METI is a driver for the establishment of industrial clusters to encourage innovation; in addition, It promotes the concept of industrial complex integrating plants of different industrial sectors and where energy and resource would be used in a most ideal way. METI and MOE introduced the eco-town initiative in 1997<sup>34</sup>. They also works on the strategic development of energy and environmental cooperation with Asian countries (see <http://www.meti.go.jp> and <http://www.env.go.jp/en/> ).

As a part of METI, the Agency of Natural Resources and Energy (ANRE) deals with, inter alia, energy conservation policy, and new energy policy (<http://www.enecho.meti.go.jp/english/index.htm>).

METI works with or through a range of affiliate agencies, including:

- New Energy and Industrial Technology Development Organization (NEDO). NEDO is Japan’s largest public management organisation promoting R&D as well as the dissemination of industrial, energy and environmental technologies. It sets out to both enhance Japan’s industrial competitiveness and address energy and global environmental problems. It implements two policies: promotion of R&D through the concept of Selecting and Focusing; and responsive revisions to project plans through objective evaluations. Supported research areas range from advanced industrial technologies to innovative new energy and environmental technologies. Activities to disseminate new energy and energy conservation technologies are also promoted. NEDO’s mission is to enhance Japan’s industrial competitiveness and address energy and global environmental problems, and its role is to comprehensively coordinate and professionally manage R&D activities (<http://www.nedo.go.jp/english/>).
- The Research Institute of Economy, Trade and Industry (RIETI); RIETI was established in 2001 as a new platform to bring about creative and innovative policy debates based on world-class research, analysis and policy studies from mid- and long-term strategic perspectives (<http://www.rieti.go.jp/en/index.html>);
- National Institute of Advanced Industrial Science and Technology (AIST). AIST is one of the largest independent administrative institutions in Japan. In 2001, 16 research laboratories from the former Agency of Industrial Science and Technology were merged. Its mission is to

<sup>31</sup> See also the Japan Patents Office <http://www.jpo.go.jp>

<sup>32</sup> The Resource Recycling Promotion Law entered into effect in 1991 and later amended to Law for the Promotion of Utilization of Recyclable Resources. A wider range of laws supporting the move towards creating a sustainable society based on the 3Rs is available at <http://www.meti.go.jp/policy/recycle/main/english/law/legislation.html>

<sup>33</sup> [http://www.enecho.meti.go.jp/english/policy/new\\_energy/outline.html](http://www.enecho.meti.go.jp/english/policy/new_energy/outline.html)

<sup>34</sup> [http://enviroscope.iges.or.jp/modules/envirolib/upload/973/attach/973\\_eco-industrial-clusters.pdf](http://enviroscope.iges.or.jp/modules/envirolib/upload/973/attach/973_eco-industrial-clusters.pdf)

(a) contribute to a sustainable society by engaging in R&D strategically, (b) strengthen the industrial competitiveness through innovations in industrial technology by enhancement of its function as the innovation hub, (c) contribute to local industrial development by strengthening the cooperation among local industries, academia and governments, and (d) contribute to industrial technology policies to be undertaken by the Japanese government, by understanding and analyzing the environment of the industrial technology, and proposing policies about mid- and long-term industrial technology strategies. Most research areas at AIST deal with energy conservation ([http://www.aist.go.jp/index\\_en.html](http://www.aist.go.jp/index_en.html)).

AIST has developed the concept of Full Research, which means a continuous mode of research from basic research to product realisation research aimed at commercialising products. It considers itself as a mediator between academia and industry, through the exchange of human resources, technology and information. AIST has created a system for technology transfer which contributes to more advanced industrial activity and the creation of new industries based on the intellectual property created through R&D at the Institute; the patent rights of an invention originating from an AIST researcher are transferred to AIST. To implement the patent, the Center searches for an implementing company through the services of a technology licensing office (TLO). When AIST staff create new ventures, the ventures are accredited as AIST ventures, and the Institute may choose to offer support such as preferential use of facilities and reduced royalties (see [AIST Technology Transfer policy](#)).

*Ministry of Education, Culture, Sports, Science and Technology (MEXT)*

The Science and Technology Policy Bureau is responsible for the planning and drafting of basic science and technology policies. The Bureau is also responsible for the formulation of research programs and promotion of research evaluation, training of researchers and technicians, regional science and technology promotion (<http://www.mext.go.jp/english/>).

*Ministry of Land, Infrastructure, Transport and Tourism (MLIT)*

The MLIT was established in 2001, through the consolidation of the former Ministry of construction, Ministry of Transport, National Land Agency and Hokkaido Development Agency. MLIT's responsibilities include collectively promoting national land planning policies, infrastructure policies, social fund maintenance and transport policies, etc. While MLIT does not have eco-innovation as an explicit goal, two of its goals are related - goal 2 on Enhancing Global Competitiveness and goal 4 on Preserve and Create a Beautiful and Benign Environment ([www.mlit.go.jp](http://www.mlit.go.jp)).

*The Council for Science and Technology Policy (CSTP)*

The CSTP is a major policy council of the Cabinet Office; it institutionalises cooperation between Ministry of the Environment, METI and other governmental agencies. It was established in January 2001 (<http://www8.cao.go.jp/cstp/english/index.html>). The mission of the CSTP is:

- to undertake comprehensive planning of the promotion of science and technology;
- to set policy for the distribution of the budget, personnel and related resources as well as other measures for the promotion of science and technology;
- to undertake wide-ranging evaluations of research activities and other important national research activities;

- on the occasion of importance, to seek out questions and provide an opinion to the Prime Minister.

*The Japan Science and Technology Agency (JST)*

JST's mission is to promote science and technology in Japan by conducting a broad range of activities, including the following (see <http://www.jst.go.jp/EN/>):

- Promotion of consistent research and development from basic research to commercialization with particular emphasis on the creation of new technological seeds;
- Upgrading the infrastructure for the promotion of science and technology, including dissemination of scientific and technological information

*The Energy Conservation Centre, Japan (ECCJ)*

The Energy Conservation Centre contributes to promoting the efficient use of energy, protection of the global warming and sustainable development (see [http://www.eccj.or.jp/index\\_e.html](http://www.eccj.or.jp/index_e.html)).

*Business – Nippon Keidanren*

Nippon Keidanren (Japan Business Federation) is a comprehensive economic organization born in May 2002 by amalgamation of Keidanren (Japan Federation of Economic Organizations) and Nikkeiren (Japan Federation of Employers' Associations). Its membership of 1,662 is comprised of 1,343 companies, 130 industrial associations, and 47 regional economic organizations (as of June, 2007) (<http://www.keidanren.or.jp/>).

The mission of Nippon Keidanren is to accelerate growth of Japan's and world economy and to strengthen the corporations to create additional value to transform Japanese economy into one that is sustainable and driven by the private sector.

In 1997, Keidanren business federation adopted its “*Voluntary Action Plan on the Environment*”, a commitment to reduce emissions of carbon dioxide by 2010 to a level lower than year 1990. By the year of 2005, 35 industries were engaged in applying measures toward this goal (altogether representing 45% of Japan's total CO<sub>2</sub>- emissions in 1990). A follow-up has shown that CO<sub>2</sub> emissions for 2004 were 0.5% lower than in 1990, and the reduction target has been achieved every year since 2000 (Nippon Keidanren, Nov 2005).

***Policy documents related to eco-innovation***

Some of the main policy documents related to eco-innovation in Japan include:

- *Becoming a Leading Environmental Nation in the 21st Century: Japan's Strategy For A Sustainable Society - 2007*<sup>35</sup>;
- *Third Science and Technology Basic Plan (2006-2010)*;
- *Intellectual Property Strategic Programme*;

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<sup>35</sup> <http://www.env.go.jp/en/focus/attach/070606-b.pdf>

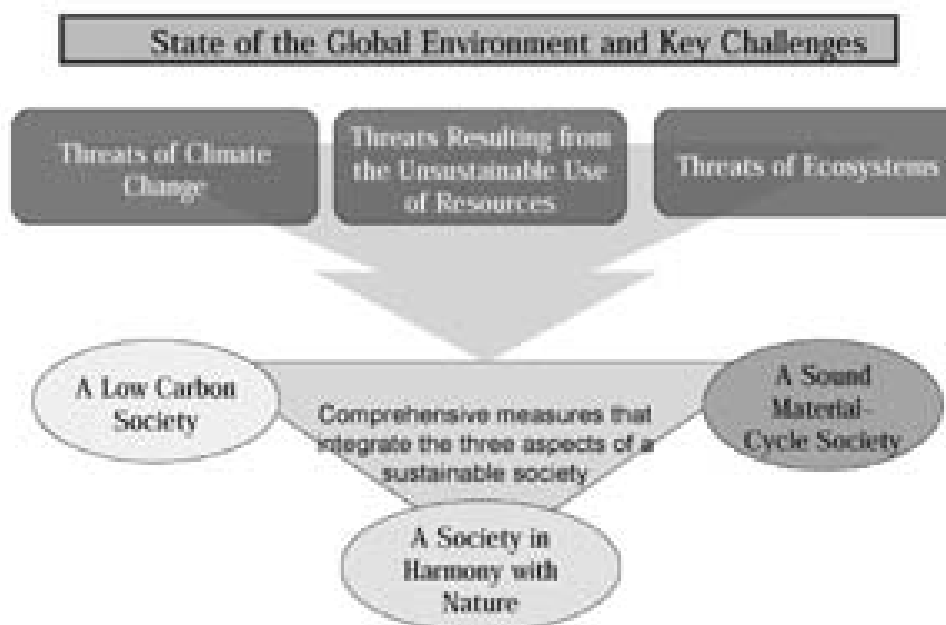
- Keys to create innovations and promote eco-innovation -2007;
- Economic Growth Initiative -2007;
- Economic and Fiscal Reform 2007: Basic Policies -2007;
- Cool Earth-Innovative Energy Technology Program-2008.

In addition, there is a range of other policy documents where innovation is encouraged. These include the Biomass Nippon Strategy (focusing on encouraging biomass as part of the renewables ambitions), the new Innovation 25 which is a long-term strategy initiative for the creation of innovation contributing to growth with a time perspective of 2025; it has an eco-innovation angle<sup>36</sup>, as it is acknowledged that eco-innovation can both solve problems that have global scale constraints (such as those on environment, resources and energy), and become the driving force behind economic growth at domestic and global level.

*Becoming a Leading Environmental Nation Strategy in the 21st century*

Japan's strategy for a sustainable society was decided by the Cabinet in June 2007. It proposes to build sustainable society through comprehensive measures integrating the three aspects of the society, specifically, a "low carbon society, a "sound material-cycle society" and a "society in harmony with nature. It shows eight strategies which should be implemented with priority in the next one to two years<sup>37</sup> (see <http://www.env.go.jp/en/focus/attach/070606-b.pdf>).

**Figure 2. The Strategies supporting Japan's strategy for a sustainable society**



<sup>36</sup> [http://www.kantei.go.jp/foreign/innovation/okotae2\\_e.html](http://www.kantei.go.jp/foreign/innovation/okotae2_e.html)

<sup>37</sup> [http://www.rrcap.unep.org/envhealth/event/HL/05\\_Japan.ppt](http://www.rrcap.unep.org/envhealth/event/HL/05_Japan.ppt)

*Third Science and Technology Basic Plan (2006-2010)*<sup>38</sup>

This is the third in a series of science and technology (S&T) plans. It builds on the Science and Technology Basic Law of 1995. One of the 6 specific goals of this plan is Goal 3: 'Economic Growth and Environmental Protection' which is part of the objective: *Maximize National Potential, to create a competitive nation for achieving sustainable growth*. The plan makes grants available for research.

*Intellectual Property Strategic Programme*<sup>39</sup>

Intellectual Property Strategy Headquarters (IPHQ), which was established in March 2003 based on the Intellectual Property Basic Act, has annually formulated the Intellectual Property Strategic Programmes (IPSP). The measures being taken by the government to create, protect and exploit intellectual property are supposed to be included in the Programmes. The IPSP sets out to promote innovation by promoting intellectual creation, appropriately protecting such creation and accelerating its effective exploitation.

**Policies, Initiatives and instruments – a national inventory**

***Research and Development***

Japan is a world leader in terms of R&D expenditure. R&D spending has been estimated at around 3.1% of GDP in 2004 and above 3.5% in 2005. Funding for Science and Technology has increased from 3.6 trillion Yen (FY2005) to 3.8 trillion Yen (FY2006) and is implemented by the various Ministries, on the basis of a general plan of the Council for Science and Technology Policy (CSTP).

Several funds and initiatives have been set up to promote the R&D phase of new environmental technologies, especially in the context of METI, via NEDO (New Energy and Industrial Technology Development Organization, an affiliate of METI) and AIST (National Institute of Advanced Industrial Science and Technology, an affiliate of METI).

*The Global Environment Research Fund*

The Global Environment Research Fund (GERF) is a competitive grant scheme for global environment research, initiated in 1990 with calls for proposals. Since then, the GERF has played a role as a core fund in Japan for promoting global environment studies through interdisciplinary interaction among natural, social and political sciences. Research areas cover global system changes, transboundary pollution, conservation and recovery of broad-regional ecosystems, sustainable societies and policies for their implementation. The annual budget is about 25 million USD.

Each year the Ministry of the Environment formulates a "Global Environment Research Program" through consultation with external reviewers. Based on the program, research projects are conducted in a timely fashion in accordance with the international situation, reflecting domestic/international trends in global environmental research. Applicants are to be researchers belonging to Japanese research institutions. Selected projects include:

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<sup>38</sup> [http://www8.cao.go.jp/cstp/english/basic/3rd-BasicPlan\\_06-10.pdf](http://www8.cao.go.jp/cstp/english/basic/3rd-BasicPlan_06-10.pdf)

<sup>39</sup> <http://unpan1.un.org/intradoc/groups/public/documents/APCITY/UNPAN010247.pdf>

- Development of GHG Sink/Source Control Technologies through Conservation and Efficient Management of Terrestrial Ecosystems – Intermediate to Long-Term Strategies for the Stabilization of Atmospheric GHG Concentration – (FY2003-2007);
- Japanese Climate Policy Scenarios towards the Year 2050 (FY2004-2008);
- Comprehensive Assessment of Climate Change Impacts to Determine the Dangerous Level of Global Warming and Appropriate Stabilization Target of Atmospheric GHG Concentration (FY2005-2009);
- Integrated Research on Climate Change Scenarios to Increase Public Awareness and Contribution to the Policy Process (FY2007-2011).

*Programmes managed by METI and its affiliate bodies*

METI has a budget of 503,300 million Yen (3,483 million Euro)<sup>40</sup>. It disburses funds to a range of agencies (NEDO, etc.) and itself supports universities, public research organisations and the not-for-profit sector for R&D. The main issues for METI are industrial competitive performance and environmental and energy problems.

The role of NEDO

NEDO promotes research and development across a wide spectrum of technological stages through the following activities:

- National projects (medium- to long-term, high-risk R&D projects);
- Support for practical application by business enterprises;
- Grants to universities and other research organizations for the discovery of technological seeds.

Drawing on the combined efforts of industry, academia and government, NEDO mainly carries out national R&D projects that stimulate the economy through enhanced Japan's industrial competitiveness. It also endeavours to provide solutions to energy and environmental problems.

The role of AIST<sup>41</sup>

AIST covers six research fields, i.e. life science & technology, information technology & electronics, nanotechnology, materials & manufacturing, environment & energy, geological survey and applied geoscience, metrology and measurement technology. In particular, AIST is engaged in developing technologies based on sustainable energy having low environmental impact.

<sup>40</sup> The exchange rate used in this report is: 1 Euro = 144.5 Yen

<sup>41</sup> [http://www.aist.go.jp/aist\\_e/aist\\_laboratories/4environment/index.html](http://www.aist.go.jp/aist_e/aist_laboratories/4environment/index.html)

### ***Verification of technologies***

#### *Japan - Environmental Technology verification programme (J-ETV)*

Japan has had an environmental technology verification programme since 2003 – J-ETV. It is under the responsibility of the Ministry of the Environment, which coordinates three advisory groups: the ETV Program Advisory Committee, Working Groups in each category, and the Technology Verification Committee. The Verification Organizations, which include some of local government and public-interest corporations, report to the MOE (see <http://www.env.go.jp/policy/etv/en/index.html><sup>42</sup>).

Environment technology verification is seen as less of a certification program (technologies are not judged as good or bad according to some standard) and more of a program for advanced environmental technologies for which no objective performance data exist. The objective is to promote the spread of technology by having independent parties verify the performance of the technologies. This is expected to promote both environmental protection and environmental business.

The pilot period to establish a verification system was 2003-2007. Starting in FY2008, the verification programme is being implemented. The budget for FY 2008 is 180 million yen and suppliers contribute part of the costs of verification in some categories.

#### ***Performance Targets***

Key initiatives with performance targets have been developed under a range of laws and regulations. In particular, the Revised Energy Conservation Law (1998) established tougher energy consumption efficiency standards on equipment by adopting the Top Runner Programme. There is a range of industry voluntary performance targets as well.

#### *Top Runner Programme*

The Top Runner programme is prescribed under the "Law Concerning the Rational Use of Energy (Energy Conservation Law, Section 6: Measures Related to Machinery and Equipment). It is a high profile, internationally acclaimed programme that has successfully encouraged innovation in a range of areas.

The Top Runner Programme works by setting energy efficiency targets at industry level, based on the value of the most energy-efficient products on the market at the time; targets are periodically reevaluated and aligned on the performance of the best in class. Figure 3 below<sup>43</sup> shows how the programme works for passenger cars.

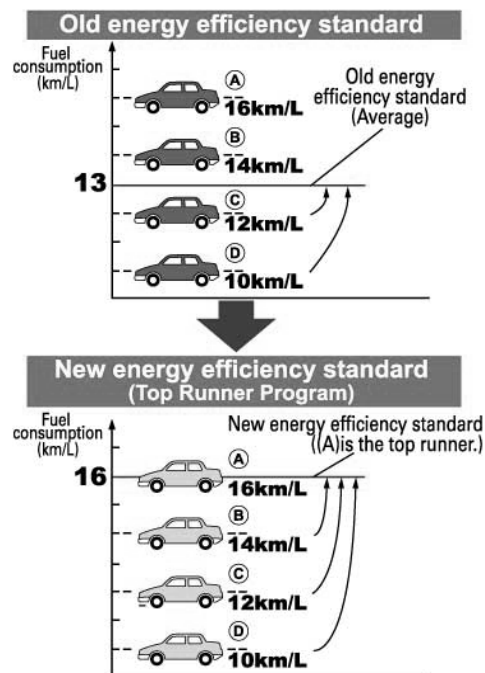
As of 2007, the Top Runner standards have been established for 21 items, from passenger vehicles, to freight vehicles, air conditioners, electric refrigerators, electric freezers, electric rice cookers, microwave ovens, fluorescent lights, electric toilet seats, TV sets, video cassette recorders, DVD recorders, computers, magnetic disk units, copying machines, space heaters, gas cooking appliances, gas water heaters, oil water heaters, vending machines and transformers. See <http://www.enecho.meti.go.jp/english/toprunner/program.pdf> and [http://www.eccj.or.jp/top\\_runner/index.html](http://www.eccj.or.jp/top_runner/index.html) for more information.

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<sup>42</sup> See also [http://www.nsf.org/business/drinking\\_water\\_systems\\_center/pdf/FinalSummaryJuly13-142005IntlForum.pdf](http://www.nsf.org/business/drinking_water_systems_center/pdf/FinalSummaryJuly13-142005IntlForum.pdf) ; [http://ec.europa.eu/environment/etap/pdfs/overview\\_env techno\\_verification.pdf](http://ec.europa.eu/environment/etap/pdfs/overview_env techno_verification.pdf); [http://www.epa.gov/etv/pdfs/publications/forum\\_jul2005.pdf](http://www.epa.gov/etv/pdfs/publications/forum_jul2005.pdf)

<sup>43</sup> <http://www.enecho.meti.go.jp/english/toprunner/program.pdf>

Figure 3. The Top Runner Programme



*Industry-led voluntary performance targets*

In Japan industry-led voluntary performance targets are common place, and industry is seen as a proactive motor for innovation, driven by resource efficiency considerations and the ensuing competitiveness benefits. Box 1 highlights selected examples.

**Box 1. Industry-led voluntary performance targets**

Nippon Keidanren

In the industrial and energy conversion sectors, in 1997 the Keidanren took the lead in formulating Keidanren Voluntary Action Plan on the Environment, and established the target of limiting carbon dioxide emissions in FY2010 to under  $\pm 0\%$  of FY1990 levels. To date 34 industries have formulated voluntary action plans on the environment establishing quantitative targets for each industrial classification. These action plans now cover approximately 80% of the industrial and energy conversion sectors.

Each industrial classification voluntarily decides which of four indicators—energy intensity, energy consumption, carbon dioxide emissions intensity, carbon dioxide emissions—it will select as targets of the voluntary action plan for their own industrial classification.

Toshiba

Toshiba launched its Fourth Voluntary Environmental Plan in 2005 - it provides further concrete targets on eco efficiency (factor performance - calculated by comparing the amount of value created and the amount of environmental impacts) for the achievement of the Environmental Vision 2010. In fiscal 2006, compared with fiscal 2000, product eco-efficiency and business process eco-efficiency improved and were 1.68 times and 1.22 times respectively, and overall eco-efficiency was 1.59 times.

Canon

In 2003, Canon put forth the overriding indicator Factor 2 for their 2010 Vision. Factor 2 represents the goal of at least doubling overall lifecycle environmental efficiency (consolidated net sales divided by lifecycle CO2 emissions) by 2010, using 2000 as the baseline date. They set Mid-Term Environmental Goals (2004-2005) to serve as milestones, and in 2005 they achieved almost all the individual goals.

Source: [http://www.kyomecha.org/pdf/kp\\_achieveplan.pdf](http://www.kyomecha.org/pdf/kp_achieveplan.pdf), <http://www.toshiba.co.jp/env/en/management/plan.htm>,  
<http://www.canon.com/environment/charter/factor2.html>

*Legislation-based performance targets*

Japan has a range of performance targets integrated into legislation, using emission limit values. Examples include:

- Drinking water: because of evidence of the human health impacts of boron and fluorine, Japan introduced effluent standards in 2001 of 10 mg/L for boron and 8 mg/L for fluorine, with the exception of seawater<sup>44</sup>;
- Air pollution: Japan's Air Pollution Control Law (amended in 2004, entered into force in 2006);
- Energy Conservation Law - amended in April 2003<sup>45</sup>;
- Reinforcement of Energy Saving for Plants, Buildings, and Transportation (2005).

<sup>44</sup> [http://www.nsf.org/business/drinking\\_water\\_systems\\_center/pdf/FinalSummaryJuly13-142005IntlForum.pdf](http://www.nsf.org/business/drinking_water_systems_center/pdf/FinalSummaryJuly13-142005IntlForum.pdf)

<sup>45</sup> obligation was imposed on such buildings to make a regular report and formulate a medium- and long-term plan for energy use

To improve energy efficiency, the government relies on boosting innovation and on carrying out internal reforms to speed up the demand for innovative products and companies. Governmental measures to achieve this goal include the establishment of performance standards for specific sectors such as housing.

The activities to reduce oil dependence in the transport sector include: standards to promote fuel efficiency of passenger vehicles; new blending limit regulation of oxygenated compounds that contain ethanol by 2020; support for regional efforts leading to increased ethanol production; and dissemination of electric and fuel cell vehicles including support the development of safe, efficient, low-cost hydrogen storage technology.

### ***Mobilisation of Financing***

The main initiatives to finance R&D programmes have already been mentioned.

The Industrial Cluster Policy illustrates how public support can be used to access market and private financial resources. In 2001, Japan also launched an Industrial Cluster Policy following the international debate on Clusters and Systems of Innovation. Some of METI's Industrial Clusters relate to environmental themes<sup>46</sup>. Budget moneys are available for industry-academic network formation, technical development, incubator and related facilities for entrepreneurs, and market development and collaboration with financial institutions.

The Eco-town projects illustrate how central government initiatives can generate local actions. The Ministry of Economy, Trade and Industry (METI) and the Ministry of the Environment (MOE) introduced the eco-town initiative in 1997. Financial support by both ministries triggered regional scale initiatives that targeted the effective resource circulation of a full range of by-products based on three industrial ecological principles: (a) the zero emissions concept; (b) principle of 3Rs; and (c) green procurement and EMSs. There are 26 eco-town projects in Japan. There are also efforts to promote cooperation among eco-towns through clustering<sup>47</sup>.

### ***Market-based Instruments***

The focus here will be on:

- Subsidies and public support schemes - for renewables (e.g. photovoltaics);
- Voluntary Domestic Emissions Trading Scheme (J-VETS).

### ***Subsidies and support schemes for renewables***

The 5-Year Plan for Photovoltaic Power Generation Technology Research and Development (FY2001 -FY2005) follows two generations of programmes designed to support the development of photovoltaic technologies in Japan (from 1974 on). Each plan has increased levels of support as the technology develops.

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<sup>46</sup> Ibid last footnote

<sup>47</sup> <http://gec.jp/gec/EN/Activities/2005/Eco-Towns/GEC.pdf>. See Michael G Norton *Japan's eco-towns - industrial clusters or local Innovation systems?*  
<http://journals.iss.org/index.php/proceedings51st/article/view/535>

In addition to RD&D funding, the market has been supported through net metering and capital grants (including to residential areas, industry, and government offices) and procurement requirements<sup>48</sup>. Solar photovoltaic capacity increased from 19 MW in 1992 to 453 MW in 2001<sup>49</sup>, an average annual growth rate of more than 42% and stood at near 1,132 MW in 2004. The target for 2010 is 4,820 MW.

There is also public support for wind and, increasingly, for biomass power (see <http://www.iaa-pvps.org/ar05/jpn.htm>).

#### *Japan's Voluntary Domestic Emissions Trading Scheme (J-VETS)*

Japan's voluntary emissions-trading scheme has been set up to accumulate knowledge and experience on cost-efficient emissions reduction and trading. The government provides economic incentives for the corporations that endeavour to achieve reduction targets they have determined themselves and implements voluntary participation to trade of emissions allowances, for domestic emissions.

One third of the cost of CO<sub>2</sub> reduction activities is subsidised by the government, as an incentive. However, should firms fail to achieve the target, the subsidy will have to be returned to the government<sup>50</sup>.

#### **Procurement**

Green public procurement became mandatory in Japan in 2001, when the law on the Promotion of Procurement of Eco-Friendly Goods and Services by the State and Other Entities (Law on Promoting Green Purchasing) was passed. The law requires all governmental institutions to develop green procurement policies, set targets, implement and report to the Environment Minister every year. It requires efforts from local governments and private sector as well. It provides evaluation criteria and a database of eco-products. The Ministry of the Environment discusses with all ministries to identify which products should be covered.

More concretely, the law requires that all general official vehicles are low-emission vehicles. For official vehicles other than general official vehicles, it sets quantitative targets for switching to the use of low-emission vehicles.<sup>51</sup>

The Green Purchasing Network was established in 1996 to promote the concept and practices of green purchasing in Japan and to provide purchasing guidelines. Guidelines have been developed for sixteen products (from copiers to workwear) and services (from offset printing to hotels & inns); additional ones are in progress.

In 2005 the International Green Purchasing Network (IGPN, <http://www.igpn.org/>) was launched (based on the Sendai declaration), with partners from around the world, to:

- promote the development of environmentally friendly products and services and Green Purchasing activities around the world;

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<sup>48</sup> The Renewables Portfolio Standard (RPS) Law newly established in 2002, obliged energy suppliers the use of a certain percentage of renewable energy.

<sup>49</sup> <http://data.iaa.org/ieastore/assets/products/eptnotes/feature/4Q2004.pdf>

<sup>50</sup> <http://www.iges.or.jp/en/cp/pdf/activity06/07.pdf>

<sup>51</sup> [http://www.kyomecha.org/pdf/kp\\_achieveplan.pdf](http://www.kyomecha.org/pdf/kp_achieveplan.pdf) p.64

- collect and share information on global Green Purchasing activities, the best examples, know-how, products information, purchasing policies and recent trends;
- harmonise the efforts of Green Purchasing and the development of environmentally friendly products and services from the global viewpoint.

One of major aims for the next five years is to develop a global green purchasing database.

### *Awareness raising and training*

There is a range of awareness raising and training initiatives in Japan<sup>52</sup>, with a number of ministries sharing efforts. Examples include:

- Cool Biz and Warm Biz – lifestyle and use of air conditioning innovation;
- Leading by Example – innovative technologies and the Prime Minister’s Official Residence;
- Labels and certificates.

METI considers that environment management performances and product environment performances should be made more visible so that companies and products having high environment values enjoy preferred positions in the market.

Legislation is also being revised to support wider awareness. For example, the government of Japan will promote environmental conservation activities and environmental education based on the Law for Enhancing Motivation on Environmental Conservation and Promoting Environmental Education (Law No. 130 of 2003) – the prime aim being to encourage GHG emission reductions.

#### *“Cool Biz” and “Warm Biz”<sup>53</sup>*

This initiative is more a social eco-innovation than a technological one. Business people are invited to wear cool and comfortable clothes that are appropriate for business occasions, shedding ties and jackets. This “Cool Biz” campaign was widely accepted by the majority of companies and people, and it reduced electricity demand during the summer months. It also reduced emissions by 460,000t-CO<sub>2</sub>, which represents monthly emissions of 1 million households.

Similarly, Warm Biz promotes the idea of “wear more clothes if you are cold, don’t depend on the heater”<sup>54</sup>, note that, in Japan, heating consumes 2.5 times more energy than air conditioning.

#### *Leading by Example*

The Prime Minister’s Official Residence and the government buildings have adopted a range of eco-technologies to set a good model for the general public. At the official residence of the Japanese Prime Minister, fuel cell systems, solar panels on the roof, and small-scale wind power generation have been installed.<sup>55</sup>

<sup>52</sup> <http://www.env.go.jp/en/focus/attach/070606-b.pdf>

<sup>53</sup> [http://www.env.go.jp/earth/cop/cop11/climate\\_c.pdf](http://www.env.go.jp/earth/cop/cop11/climate_c.pdf)

<sup>54</sup> [http://www.env.go.jp/earth/cop/cop11/climate\\_c.pdf](http://www.env.go.jp/earth/cop/cop11/climate_c.pdf)

<sup>55</sup> [http://www.env.go.jp/earth/cop/cop11/climate\\_c.pdf](http://www.env.go.jp/earth/cop/cop11/climate_c.pdf)

### *Labels and certificates*

The Ministry of the Environment is in charge of eco-labelling, via the Japan Environment Association: to promote environment-friendly lifestyles through wise product choice, the Japan Environment Association (JEA) manages the Eco Mark Program aimed at certifying and spreading Eco-friendly products. A committee composed of academics, governments, consumer groups, and experts from various industries sets standards and carries out the certification. The Eco Mark is labelled on products with relatively less environmental impact compared to similar products, during the entire life cycle, from exploiting and collecting the product materials, to the manufacturing, distribution, use and consumption, disposal, and recycling. After screening Eco-friendly products submitted for approval by manufacturers, the JEA certifies and publicizes products qualifying for the Eco Mark. As of September 30, 2008, the number of product categories is 48 and the number of certified products is 4,315.



The JEA serves as the General Affairs Office for the Global Ecolabelling Network(GEN). GEN is a non-profit association consisting of 27 organizations (25 members, 2 associates) that are implementing ecolabelling programs similar to the Eco Mark. Its role includes making certification standards identical, appealing the network's endeavours, information exchange, providing information on the Internet, supporting the launch of new eco-labelling programs all over the world, etc.

Other Ministries undertake more specific initiatives. METI certifies products on the basis of energy conservation. The Ministry of Land, Infrastructure and Transport has established the Green Management Certification system for trucking firms undertaking initiatives to lower their environmental burden by more than a certain amount (e.g. measures to lower fuel consumption).

### *Acting Globally*

Transmission of eco-innovation models to the world will be an integral part of Japan's initiatives towards eco-innovation. Japan's international collaborations with implications for eco-innovation include:

- Collaboration on intellectual property rights (IPR);
- Clean Development Mechanism / Joint Implementation;
- Asia-Pacific Environmental Innovation Strategy Project (APEIS);
- Japanese International Co-operation Agency (JICA);

The regional component of Japan's strategy for energy efficiency is highlighted below.

### *Intellectual Property Rights (IPR)*

To facilitate international collaboration on intellectual property, Japan has initiated the APEC Cooperation Initiative on Patent Acquisition Procedures, which sets out to enable applicants to more quickly obtain a higher-quality patent in the APEC region. In September 2007, the APEC Ministers

endorsed the initiative. Also, intellectual property issues are addressed in a number of bilateral Economic Partnership Agreement (EPA) with Singapore, Malaysia, Chile, Thailand, the Philippines, and Indonesia.

Another important intellectual property-related programme proposed/promoted by Japan is a Patent Prosecution Highway. This system ensures that applications for which patents have been granted in the first country will be eligible for accelerated examination through simple procedures in a second country.

#### *Clean Development Mechanism / Joint Implementation (CDM/JI) projects*

As of October 2007, the Japanese government had approved a total of 242 CDM/JI projects in, *inter alia*, Chile, Thailand, Vietnam, Bhutan, South Korea, Brazil, and Kazakhstan.

NEDO and the Global Environment Centre Foundation (GEC) publicly solicits project proposals and entrusts feasibility studies to Japanese entities including private companies and NGOs in order to facilitate the process to realize CDM/JI projects focusing on energy conservation technologies in the steel industry, the cement industry, the food industry and other industries, as well as methane collection technologies, power generation technologies including biomass, solar, wind and hydro power generations, afforestation/reforestation, etc.

Under NEDO programme, during 1998 through 2007, 318 feasibility studies were made in 48 countries, and under GEC programme, between 1999 and 2007, 141 feasibility studies were undertaken in 33 countries and 1 region consisting of Pacific small islands<sup>56</sup>.

#### *Asia-Pacific Environmental Innovation Strategy Project (APEIS)*<sup>57</sup>

The APEIS is supported by the MoE. It was endorsed at ECO ASIA<sup>58</sup> in 2001. It entails knowledge-based tools for decision-making, including good practices inventory and innovative policy instruments inventory. There is also a focus on environmental markets (environmental industry and environmental finance), environmental technologies (renewable energy and information technology) and eco-consciousness (environmental education and participation).

#### *Japanese International Co-operation Agency (JICA)*

JICA's budget was 1,354 million USD in 2004<sup>59</sup>.

JICA is working with developing countries to tackle environmental problems via programmes on environmental management, nature conservation, waste resources and disaster management and natural resources and energy. Initiatives in this area include support for environmental centres, assistance with waste processing, and countermeasures for pollution and acid rain (<http://www.jica.go.jp/english/>).

<sup>56</sup> [http://www.nedo.go.jp/english/archives/170927\\_2/cdm\\_schemes.pdf](http://www.nedo.go.jp/english/archives/170927_2/cdm_schemes.pdf)

<sup>57</sup> [http://www.eoc.csiro.au/modis/apeis\\_2/1st-day\\_2003-11-28/00\\_Takamoto.pdf](http://www.eoc.csiro.au/modis/apeis_2/1st-day_2003-11-28/00_Takamoto.pdf)

<sup>58</sup> Eco Asia is a network of Environmental ministers and international organizations from the Asia-Pacific region

<sup>59</sup> [Http://ecoinnovationfinancingconference.rec.org/downloads/presentations/japan\\_ecoinnovationshort.pdf](http://ecoinnovationfinancingconference.rec.org/downloads/presentations/japan_ecoinnovationshort.pdf)

### *Regional cooperation for energy efficiency*

Japan encourages energy efficiency through promoting energy conservation standards and assessment systems by sectors in the Asia-Pacific region. In particular, Japan seeks to establish a regional framework to save energy. The “Asia Energy and Environmental Cooperation Strategy” seeks to promote energy conservation by working with other countries in Asia mainly, China and India, given the rapid increase of their energy demand. Other candidates as priority countries are Thailand, Indonesia, and Vietnam.

The cooperation framework would tackle the following five areas:

- Energy efficiency or conservation: The activities include setting up energy efficiency standards and labelling systems (for the consumer, transport, and electricity sectors); industry dialogues as well as the use of international approaches such as the clean development mechanism; assess energy efficiency efforts using international benchmarks; and collaboration with the International Energy Agency.
- Development of “new energy”: The goal is to accelerate the adoption of new energies in the participating countries by promoting training, dispatch of experts throughout the region, and the development of new energy technologies.
- Clean coal: The objective is to promote the dissemination of clean and safe coal technologies in Asia through training programs, experts dispatching, and technological development and testing. Cooperation will be promoted in the area of coal liquefaction technology.
- Stockpiling: Japan proposes to build an effective stockpiling Asian scheme by developing a regional framework that facilitates cooperation and exchange.
- Nuclear power: The goal is to promote a common framework to safely develop this type of energy.

### **Country Synthesis**

#### ***Strategic highlights***

Japan has ambitions to become a *Leading Environmental Nation* as declared in its “Strategy in the 21st Century: Japan's Strategy for a Sustainable Society”. A number of key strategic policy documents explicitly refer to that concept. The promotion of eco-innovation is a joint responsibility of all the ministries involved. In Japan, eco-innovation, defined as a new field of techno-social innovations, explicitly covers three areas:

- industry: working towards sustainable manufacturing which utilizes recycling resources and reduces resources;
- infrastructures: deployment of zero-emission social infrastructures, e.g. zero-emission-type coal fired power generation with efficient coaling/carbon capture and storage, and distribution and diversification of energy sources using IT technology etc.,
- consumers and lifestyles: realizing sustainable consumption and life-style. Japan considers that innovations are not realized by technological seeds alone. They must be recognized as offering values that are appreciated by the consumers of a sustainable society.

Therefore, an eco-innovation roadmap, from Japan's perspective, should cover necessary changes in social systems.

The Ministry of Economy, Trade and Industry (METI) plays a central role, in coordination with the Ministry of the Environment. METI, and its affiliate bodies (NEDO, AIST) bring a clear orientation towards economic development and national competitiveness. Cooperation with industry is an essential trademark of Japan's policies to support eco-innovation.

One feature of Japan's policies is a heavy reliance on public support to R&D. Japan is a world leader in terms of R&D expenditure, which amounted to 3.5% of GDP in 2005. Several funds and initiatives have been set up to promote the R&D phase of new environmental technologies.

Under METI's initiative, most projects are geared towards industrial development. AIST has created a system for technology transfer which contributes to more advanced industrial activity and the creation of new industries based on the intellectual property created through R&D at the Institute; the patent rights of an invention originating from an AIST researcher are transferred to AIST. To implement the patent, the Center searches for an implementing company through the services of a technology licensing office (TLO). When AIST staff create new ventures, the ventures are accredited as AIST ventures, and the Institute may choose to offer support such as preferential use of facilities and reduced royalties

Targets related to energy efficiency and environmental performance play a crucial part in Japan's policies to support eco-innovation. Industry is considered as a proactive motor of innovation and the system entails a number of industry-led voluntary performance targets. In addition, the government initiates dynamic targets which incentivize industries to over perform the market (see the Top Runner Programme).

Japan devotes a particular interest to social (not merely technological) innovation. This is illustrated by the Cool Biz and Warm Biz initiatives and a number of programmes which set out to adjust life-styles and consumption patterns.

In selected areas, Japan intends to play a leading role in international cooperation, at both G8 and regional level. It uses bilateral Economic Partnership agreements to foster some of its priorities (e.g. on intellectual property) and initiates a number of initiatives in South East Asia (e.g. on energy efficiency or conservation).

## Appendices

### *Summary table*

Actions	Initiatives
Research and Development	METI, NEDO, AIST
Verification of Technology	JETV
Performance Targets	The Top-Runner Programme Environmental Laws Industry self commitments/ voluntary agreements.
Mobilisation of Financing	NEDO METI
Market-based Instruments and State Aid	Vehicle taxes Subsidies and public support schemes - for renewables (Eg PV) Voluntary Domestic Emissions Trading Scheme (J-VETS)
Procurement	Green Procurement Law International Green Purchasing Network (IGPN)
Awareness Rising and Training	“Team -6% Campaign” “Cool Biz” – lifestyle and use of air conditioning innovation Warm Biz, Leading by Example – innovative technologies and the Prime Minister’s Official Residence Using of labels and certificates
Acting Globally	Intellectual product rights (IPR) CDM and JI Asia-Pacific Environmental Innovation Strategy Project (APEIS) Japanese International Co-operation Agency (JICA)

### *Eco-industries and innovation in Japan*

Japan is a world leader in eco-innovation, building on its dependency on imports for energy/natural resources, and on opportunities for industrial policy building on resource efficient goods and processes.

The environmental market in Japan itself has been rapidly expanding since the second half of the 1990s, partly due to the advancement of environmental laws. Statistics on the size of the industry and future forecast of the environmental businesses have been reported by the Japanese Ministry of the Environment, following the OECD/Eurostat classification (MoE, 2004). The market size based on the OECD classification was approximately 30 trillion yen in year 2000, and the expected expansion was estimated to approximately 47 trillion yen by 2010 and approximately 58 trillion yen by 2020.

A forecast of the “environmentally-induced businesses” indicates that the market size would increase from approximately 41 trillion yen in 2000 to 103 trillion yen in 2025; employment would increase from approximately 1.06 million people in 2000 to 2.22 million people in 2025 (MoE, 2005).

Since the introduction of ISO 14001 in 1996, over 20,000 Japanese businesses have been certified, by far the country with the highest number of certifications in the world. The certification trend is spreading rapidly from large businesses to middle sized and small businesses and from the manufacturing sector to the service sector.

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## COUNTRY PROFILE OF THE REPUBLIC OF KOREA

### Introduction and country definitions of eco-innovation

#### *Definitions related to eco-innovation used in the country*

A definition of environmental technology is provided in the Korean Act on Environmental Technology Development and Support in Korea<sup>60</sup>. Environmental technology is defined as:

*“technology necessary for preserving and managing the environment including the enhancement of assimilative capacity, suppressing and removing causes of environmental damages on humans and nature, preventing and reducing environmental pollution, and recovering polluted and destroyed environment”.*

#### *Institutions playing a major role on eco-innovation*

In Korea, there are many governmental bodies and research institutes dealing with research and innovation. The ones listed below are the main institutions encountered in the preparation of this report.

##### *Ministry of Environment (MOE)*

<http://eng.me.go.kr/docs/index.html>

The Korean Ministry of Environment is responsible for works related to the protection of natural and ambient environment and the prevention of environmental pollution.

In the field of environmental technologies, Environmental Management Corporation (EMC) is a non-profit, representative public environmental organization under the Ministry of Environment. It specializes in environmental technology and deals with comprehensive environmental issues. Its extensive works include: reviewing and supporting environmental policies and technology application, building and operating environmental tele-monitoring systems of environmental pollution measurement, designing and supervising environmental facility construction and operation such as landfill, incinerator, wastewater treatment, drinking water and sewage pipe line, analysing and verifying environmental pollutants such as dioxin and contaminated soil, evaluating and diagnosing environmental facilities, managing watershed area, supporting national climate change response, researching and developing renewable energy technology, supporting developing countries for their environmental protection, etc.

##### *Ministry of Knowledge Economy (MKE)*

<http://english.mke.go.kr/language/eng/main.jsp>

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<sup>60</sup> Ministry of Environment, 2005

MKE (former Ministry of Commerce, Industry and Energy, MOCIE) is the ministry responsible for policies concerning industry, trade, and energy and resources. Among its tasks, MKE aims to establish an innovation-driven industry and implement policies on energy conservation, alternative energy, energy safety and development of domestic and overseas resources. One of the priorities in 2008 is working towards the establishment of a carbon market.

Korea's Energy Management Corporation (KEMCO) receives its mandate from MKE: MKE regulates; KEMCO implements and reports to MKE. The focus is on energy efficiency, new sources of energy and renewables (fuels cell, photovoltaic, and wind power).

<http://www.kemco.or.kr/>

*Ministry of Education, Science and Technology (MEST)*

<http://english.mest.go.kr/>

The mandate of MEST (created as MOST in 2004, renamed as MEST as of 2008 February 29<sup>th</sup>), is to provide central direction, planning, coordination and evaluation of all science and technology activities in the country, and to formulate science and technology policies, programs and projects including technology cooperation, space technology, and atomic energy in support of national development priorities. It has no specific programme on environment or energy, as MOE and MKE have their own research programmes.

*The Korea Eco-Products Institute (KOECO)*

[www.koeco.or.kr/eng/index.asp](http://www.koeco.or.kr/eng/index.asp)

KOECO is a public institution established by national law to promote consumption and production of environmentally preferable products. KOECO is responsible for the administration of the eco-labelling program, the management of public green procurement, and the provision of eco-products information and technical assistance for industries.

*Korean Agency for Technology and Standards (KATS)*

<http://www.kats.go.kr/english/index.asp>

The KATS is a specialized institute establishing national industrial standards (including environmental ones) and technical evaluation in Korea. Its main missions include promoting the conformity of Korean standards with international standards and certifying new technologies and quality of products for industries in Korea.

*Korea Institute of Environmental Science & Technology (KIEST)*

<http://www.kiest.re.kr/eng/index.jsp>

KIEST was established in 2001 to support the planning, evaluation and management of R&D projects in the field of environmental technology, conduct demand surveys, make technological forecasts, and facilitate the penetration and practical application of the technologies developed. It manages such programmes as the former G7 project (see below), Eco-technopia 21 Project for next generation, National Long-term Ecological Research, Geo-Advanced Innovative Action Project, Soil-Pollution Diffusion Prevention Project, PCBs Research, ET Edu-innovation Project.

Moreover, KIEST supports participation of companies in international environmental exhibitions and promotes projects on exchange of human resources with developing countries, in an effort to increase the exports of technologies.

*Regional Environmental Technology Development Centres*

Universities, administrative agencies, research institutes, industries and non-governmental organizations constitute Regional Environmental Technology Development Centers that collectively attempt to solve unique local environmental problems. The responsibilities of each center include analysis and study of local environmental pollution, development of environmental technology, environmental education and technical support to enterprises coping with environmental management problems, dissemination of new environmental technologies, and promotion and education of new environmental technologies to local people.

***Policy documents related to eco-innovation***

A number of documents related to technology and innovation are mentioned in relevant web sites and official documentation. The main ones have been listed below, though no available English version has been found.

In addition, the Special Act on Seoul Metropolitan Air Quality Improvement (which came into force in January 2005) also stimulates environment-friendly regulation. The Special Act includes the implementation of total pollution load management in industries, gradual emission reduction through wide supply of low emission vehicles, attachment of pollution-reduction device to cars, and other concrete measures to reduce air pollution.

*10-year Basic Plan for the Development and Dissemination of New and Renewable Technology*

The 10-Year National Plan for Energy Technology Development, released in 2003, selected fuel cells, photovoltaic (PV), wind power as high-priority areas. The Korean government planned to invest approximately US\$ 200 million in the development and dissemination of fuel cell from 2004 to 2011 and US\$2.42 billion for the photovoltaic<sup>61</sup>.

*Strategies for Environmental Technology Development*

The First Phase Environmental Industry Development Strategy (2001~2003) and the Mid- & Long-term Strategy on Fostering Environmental Industry (2005~2010) aimed at advancing the Environmental Technology to the level of other developed countries by 2010.

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<sup>61</sup> <http://www.oecd.org/dataoecd/12/13/31967755.pdf>

*The Long-term Vision for Science and Technology Development Toward 2025*

The Korean government launched a long-term strategic initiative, the Long-term Vision for Science and Technology Development toward 2025 (or Vision 2025), in 1999. The plan set the directions and goals of the Korean government's mid-long-term science and technology (S&T) policies. Among its major features, the plan promotes: shifting innovation system from government-led to private sector-led ones; improving the effectiveness of national R&D investment; aligning R&D system from a domestic to a global network; and meeting the challenges of the information technology and biotechnology revolution<sup>62</sup>.

*Basic Plan of Science and Technology 2003-2007*

The plan identifies, among its policy priorities, technology development for establishing sustainable economic growth.

**Policies, initiatives and instruments – a national inventory*****Research and Development***

The Korean Government leads research and development (R&D) activities in collaboration with industry, universities and research institutes. Priority projects are financed by the government budget and energy-related funds from the Government and industry. Three important long term projects focusing on R&D are:

- 21st Century Frontier R&D Program;
- Eco-Technopia 21 Project, including Eco-Star;
- National Research Laboratory (NRL).

*21st Century Frontier R&D Program*

The Frontier 21 programme, launched in 1999 and run by the MOST, is a 10 year effort to develop core technologies in near to market areas by 2010. This programme supports 23 projects in areas such as bioscience, nanotechnology, intelligence and information technology, at a total cost of over US\$3.5 billion. Among these, the government financed projects on Carbon Dioxide Reduction and Sequestration (in 2002), and on Hydrogen Energy (in 2003)<sup>63</sup>.

*Eco-Technopia 21 Project*

The project has started to follow up the G7 project since 2001, which was a 10-year project, run by MOE, launched in 1992 with the aim to develop seven areas of environmental technology to the level of G7 countries. The G7 project helped close the technological gap that existed between Korea and advanced countries – especially on the so called ‘post-treatment technologies’ (such as dust collection, advanced waste water treatment, and small-scale incineration). For example, technologies

<sup>62</sup> <http://unpan1.un.org/intradoc/groups/public/documents/APCITY/UNPAN008049.pdf>

<sup>63</sup> <http://www.britishembassy.gov.uk/servlet/Front?pagename=OpenMarket/Xcelerate/ShowPage&c=Page&cid=1101395195467>

such as high efficiency dust collecting technology and exhaust gas desulfurization technology have been upgraded<sup>64</sup>.

*Achievements:* a total of 331 projects were successfully completed by the end of 2003

The Eco-Technopia 21 Project is a ten year project, initiated in 2001. MOE plans to invest about 1 trillion Korean won (800 million USD) by 2010<sup>65</sup>, along three stages:

- 2001-2003: the focus is on the development of pollution control technologies; it followed a bottom-up approach;
- 2004-2007: the focus shifts to the development of mid- and long term strategic technologies; a top-down approach is used to designate projects;
- 2008-2010: the focus will be on environmental technology development for future generations.

The private sector is expected to invest some 348 million USD on the project. A follow-up project will be designed before the end of the third stage.

The project focuses on the promotion of environmental technology in a number of specific areas, including environmental conservation/restoration and precautionary pollution prevention. Three steps in the technology development process are being promoted: generic technology, applied technology, and technology commercialization. Eco-Technopia 21 is open to international consortia (the project leader can commission a foreign entity to take charge of part of the research); over 2004-07, 40 projects involved Chinese parties.

For systematic implementation of Eco-Technopia 21 Project, MOE developed a 10-year Master Plan for Eco-Technopia 21 in July 2002. With this plan, MOE outlined concrete goals and strategies by phases, while introducing the Technology Road Map (TRM) of the nation.

#### *Eco-STAR (Eco-Science & Technology Advancement Research)*

The Eco-STAR plan, which is a part of Eco-Technopia 21 Project developed by MOE, sets mid- and long-term strategies to develop promising environmental technologies by sector. It is focused on projects which can deliver world-class technologies that will compete on global markets. The rationale is to maximise synergistic effects through joint or multilateral R&D on projects unable to achieve targets independently. Projects are selected according to their commercialisation and success potential; they are financed through a matching fund system, where the government works with industry.

In 2004, two pilot centres were set up: the 'Centre for Environmentally Friendly Vehicle' focusing on developing technologies for vehicle emission reduction (with the investment of 65 billion won by 2010), and the 'Innovation & Integration Centre for XXIst Century Water Technology', devoted to advancing sewage and wastewater treatment technologies (with an investment of 65 billion won).

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<sup>64</sup> [http://eng.me.go.kr/docs/common/common\\_view.html?idx=28&av\\_pg=1&mcode=10&classno=15](http://eng.me.go.kr/docs/common/common_view.html?idx=28&av_pg=1&mcode=10&classno=15)

<sup>65</sup> [http://eng.me.go.kr/docs/common/common\\_view.html?idx=28&av\\_pg=1&mcode=10&classno=15](http://eng.me.go.kr/docs/common/common_view.html?idx=28&av_pg=1&mcode=10&classno=15)

Based on the outcomes and experiences from these pilot initiatives, MOE has planned to promote a gradual expansion of the Eco-STAR Project and has launched two new centres in 2007: the ‘Centre for Aquatic Ecosystem Restoration’, devoted to restore and control eco-system; and the ‘Centre for Waste Eco-Energy and Greenhouse Gases’, designed to respond to energy and climate change.

#### *National Research Laboratory (NRL)*

The programme identifies and cultivates outstanding laboratories in the fields of core technology that will be key elements for national competitiveness. This strategic national R&D program maintains and develops the core technologies that can be the common basis for many industries and products. It also supports efficient utilization of the science and technology resources in industry, academia, and research institutes throughout the nation. Up to 2005 about 40 laboratories set up in this context were related to environment<sup>66</sup>. See: [http://www.kosef.re.kr/english\\_new/programs/programs\\_02\\_03.html](http://www.kosef.re.kr/english_new/programs/programs_02_03.html)

#### ***Verification of technologies***

##### *Environmental Technology Verification (ETV) Program*

Korea ETV Program operated since 1997 is the system to certify or verify the environmental technology that developed or improved in Korea. It sets out to accelerate the development of environmental technologies and promote environmental industry.

There are two types of Korea ETV Program, i) ‘New Excellent Technology’ (NET), and ii) ‘Technology Verification’. NET consists of on-site inspection (1 day only) and document review. Technology Verification consists of on-site verification and document review; it can last from 6 to 12 months. As of January 2008, 258 technologies had been verified, 108 through technology verification, 150 through NET; water and wastewater accounted for 2/3 of overall verifications (80% of technology verifications).

Through NET and Technology Verification, technology-users can use NET-technologies with trust and enterprises can efficiently apply the developed technologies into the field. The certified or verified technologies benefit from extra points at public project biddings, the recognition of construction record, advertisement in website and conferences, etc. Ministry of environment (MOE) is supporting within 50% of verification cost for promoting commercialization of developed environmental technologies since 2003 (refer to <http://www.koetv.or.kr/eng/index.html>)<sup>67</sup>.

#### ***Performance Targets***

The main environmental performance targets are:

- Rational Energy Utilisation Plan – 2004;
- Building code standards;
- Standby Korea 2010;

<sup>66</sup> Ministry of Environment, 2005

<sup>67</sup> European Commission, 2004: Overview of Existing Environmental Technologies Evaluation/Verification Programs [http://ec.europa.eu/environment/etap/pdfs/overview\\_env techno\\_verification.pdf](http://ec.europa.eu/environment/etap/pdfs/overview_env techno_verification.pdf)

- Voluntary agreement;
- Voluntary Fuel Efficiency Standards.

#### *Rational Energy Utilisation Plan - 2004*

Since 1993, Korea has executed Rational Energy Utilisation Plans spanning five year periods. The 3rd plan (2004-2008) establishes a target of 7% reduction of the expected total primary energy consumption in 2008<sup>68</sup>.

#### *Building code standards*

To improve Korea's standards for the energy intensity of buildings, the Building Energy Policy Council began in July 2005 to review energy efficiency assessment standards and develop policies to raise energy efficiency. The building code standards are 38 kWh/m<sup>3</sup>-year for the residential sector and 130 kWh/m<sup>3</sup>-year. Korea's building insulation standard varies by region and type of building, but an average figure for outer wall insulation in urban buildings is 0.47 W/m<sup>2</sup>K<sup>69</sup>.

In 2006, the Korean government mandated every three years energy audits for buildings consuming more than 2 ktoe per year. Buildings that achieve outstanding energy performance are exempted from this requirement<sup>70</sup>.

#### *Standby Korea 2010*

MKE implemented a three-stage program with the ultimate goal of reducing standby power of each electrical device below one watt by 2010. The first voluntary stage of the plan has been running from 2005 to 2007 and targets 18 products, including computers, monitors, fax machines, etc. Products that satisfy the one-watt target will have an advantage in being chosen for government procurement. The second stage between 2008 and 2009 will prepare for the full-fledged implementation in 2010. The third mandatory stage, after 2010, will expand to 30 products.



See: [http://www.kemco.or.kr/english/sub03\\_energyefficiency02.asp?defmenu=3](http://www.kemco.or.kr/english/sub03_energyefficiency02.asp?defmenu=3)

*Achievements:* if well-implemented, the policy is expected to save 121 billion KW annually by 2010; standby power use by each household is expected to fall 4.3% by 2020 - compared to 2003 levels.

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<sup>68</sup> Source: <http://www.iea.org/Textbase/pm/?mode=re&id=2136&action=detail>

<sup>69</sup> <http://www.iea.org/Textbase/pm/?mode=pm&id=2564&action=detail>

<sup>70</sup> <http://www.iea.org/Textbase/pm/?mode=pm&id=2563&action=detail>

*Voluntary Agreement (VA)*

The Voluntary Agreement, a joint program between the government and industry, is managed by the Ministry of Knowledge Economy and the Ministry of Environment. A company which intends to join the agreement should submit a concrete action plan, specifying energy consumption and greenhouse gas emission reduction target. The company that concludes successfully a VA agreement will be provided with low interest loans and tax incentives to promote energy conservation and greenhouse gas reduction. Technical support as well as PR promotion for the company will be offered as well.

See: [http://www.kemco.or.kr/english/sub03\\_VA.asp](http://www.kemco.or.kr/english/sub03_VA.asp)

*Achievements:* as of 2004, a total of 1,021 companies have participated in the agreement, covering the fields of steel, chemicals, textiles, paper, ceramics and the food industry. They are committed to reducing their CO<sub>2</sub> emissions by 8,647 million tonnes of carbon (TC) in five years by enhancing energy efficiency by 10.6 percent through the adoption of energy efficiency technologies, installation of alternative energy utilizing facilities such as combined heat and power (CHP), improvement of manufacturing processes, utilization of clean energy sources and collected waste heat, and improvement of operation management.

*Voluntary Fuel Efficiency Standards*

The five major Korean automobile manufacturers agreed on December 2005 to improve the fuel efficiency of cars by more than 15% by 2012, and expand R&D in hybrid and fuel cell-powered vehicles. The Government imposes more stringent standards year by year.

*Achievements:* the country calls for energy savings of 220,000 kl per year, (equal to 313 billion Korean won), and reduce the emission of carbon dioxide by 350,000 metric tons annually<sup>71</sup>.

[http://www.kemco.or.kr/english/sub03\\_energyefficiency.asp?defmenu=3](http://www.kemco.or.kr/english/sub03_energyefficiency.asp?defmenu=3)

***Mobilisation of Financing***

The main financial programs related to eco-innovation include:

- Demonstration & Dissemination Program ;
- Environmental Venture Fund.

*Demonstration & Dissemination Program*

To promote the marketing of developed New and Renewable Energy (N&RE) technologies, the government subsidizes 70 percent of the associated installation costs. Some 10.5 billion won of subsidies were provided by the government from 1993 to 2003: for PV Power Generation Systems, Solar Thermal Water Heating Systems and Bio-Methane Generation Systems. Another 4.7 billion won were provided in 2004 to deploy developed N&RE technologies: PV, solar thermal water heating, geothermal systems and wind power generation systems.

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<sup>71</sup> <http://www.iea.org/Textbase/pm/?mode=weo&id=2380&action=detail>

*Achievements:* as the part of dissemination programs, the Solar-roof 100,000 Project started in 2004. The goal was to set up 100,000 solar-roofs by 2012. The government subsidized 6.4 billion won and 311 units were installed in 2004<sup>72</sup>.

#### *Environmental Venture Fund*

In order to support environmental technologies, the Korean Ministry of Environment has created an Environmental Venture Fund and has actively identified and supported promising venture companies.

Environmental Technology Business Incubator (ETBI) has been set up under the supervision of the Korea Institute of Environmental Science and Technology (KIEST) to assist venture activities of those at the frontier of environmental technology development<sup>73</sup>.

#### ***Market-based Instruments***

The most relevant market based instruments promoting eco-innovation in Korea include:

- Feed-in Tariff for Renewables (Electricity Business Law)
- Tax Incentives
- Loans
- Hybrid and Fuel-Cell Powered Vehicles Plan
- Green procurement

#### *Feed-in Tariff for Renewables (Electricity Business Law)*

The Electricity Business Law mandates both the purchase and the fixed price of electricity generated from renewable sources. Any renewable energy generator that is connected to the grid is eligible to sell electricity to the grid at fixed prices. Korea Electric Power Corporation (KEPCO) is responsible for purchasing electricity from renewables. The government compensates for the difference between N&RE power generation cost and fossil fuel generation prices.

From October 2006 on, the power sources subject to the standard price have been extended. Standard prices were ramified into nineteen prices for nine power sources. Starting in 2009, a decremental rate will be applied to photovoltaics and wind power; a decremental rate will apply to fuel cell from 2010 on. The standard price for each power source is applied for 15 years; minimal capacities are required to qualify for feed in tariff (100, 1000, 50 MW for photovoltaics, wind power and fuel cell respectively).

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<sup>72</sup> [http://www.kemco.or.kr/english/sub03\\_R&D02.asp](http://www.kemco.or.kr/english/sub03_R&D02.asp)

<sup>73</sup> European Commission, 2004: Overview of Existing Environmental Technologies Evaluation/Verification Programs [http://ec.europa.eu/environment/etap/pdfs/overview\\_env techno\\_verification.pdf](http://ec.europa.eu/environment/etap/pdfs/overview_env techno_verification.pdf)

*Tax Incentives*

The government provides tax incentives for energy efficiency investments for the replacement of old industrial kilns; the installation of energy-saving facilities; the installation of alternative fuel-using facilities and of other facilities reducing energy consumption by more than 10 %. Before 2001, the tax incentive was for 5 % of income tax credit, but it was changed to 10 % in 2001 and 7 % in 2003.

See: [http://www.kemco.or.kr/english/sub03\\_financial02.asp?defmenu=4](http://www.kemco.or.kr/english/sub03_financial02.asp?defmenu=4)

*Loans*

The Korean government has provided long-term and low interest loans from the '*Fund for the Rational Use of Energy*', along with tax incentives, for energy efficiency and conservation investments. KEMCO is responsible for its management and monitoring.

See: [http://www.kemco.or.kr/english/sub03\\_financial.asp?defmenu=4](http://www.kemco.or.kr/english/sub03_financial.asp?defmenu=4)

*Achievements:* The total loan performance was US\$515.9m in 2004

*Hybrid and Fuel-Cell Powered Vehicles Plan*

A five-year plan, developed by MKE, would allow the country to develop its own hybrid car technologies and test-drive fuel cell cars by 2010. Consumers who buy hybrid vehicles would be offered various incentives such as subsidies, tax breaks, and discounted parking fees. In addition, to further promote the use of hybrid vehicles, government agencies will purchase hybrid cars for official use.

*Achievements:* the country has started producing hybrid vehicles at the end of 2006 and is expected to reach a production capacity of 300,000 units by 2010<sup>74</sup>.

*Green procurement*

The Act on the Promotion of the Purchase of Environment-friendly Products, enforced in July 2005, aims to encourage the purchasing of environment-friendly products and services by means of mandating public agencies to buy environment-friendly products and services and supporting industry and household-level green consumption. In addition, KOECO organises the Green-Purchasing Convention.

*Achievements:* around 30,000 public agencies are now subject to participate in the green procurement systems. Eco-products market in Korea has been growing dramatically to reach 12 trillion won as of December 2006<sup>75</sup>.

*Awareness raising and training*

Several initiatives to promote the consumption and production of environmentally preferable products are coordinated by the KOECO. The main ones are the following:

- Eco-labelling Program,

<sup>74</sup> <http://www.iea.org/Textbase/pm/?mode=weo&id=2379&action=detail>

<sup>75</sup> Source: [http://eng.me.go.kr/docs/news/press\\_view.html?seq=352&page=1&mcode](http://eng.me.go.kr/docs/news/press_view.html?seq=352&page=1&mcode)

- Environmental Declaration of Products (EDP) Program,
- Other initiatives by KOECO,
- Act on the Promotion of the Purchase of Environment-friendly Products.

Other awareness raising and training programmes in Korea include:

- Kids ISO 14000 Program,
- Energy Conservation Month/Day,
- Energy Conservation Exhibition and Convention,
- Korea Environmental Technology Awards,
- National Environmental Technology Information System,
- Environmentally friendly Company Certification System.

#### *Eco-labelling Programme*

The Korea Eco-labelling Programme, operated by the KOECO, is a voluntary certification program started in 1992. The Eco-label is awarded to products meeting certain environmental standards to verify lifecycle based environmental preferability of products and services.



See: [http://www.koeco.or.kr/eng/business/business01\\_01.asp?search=1\\_1](http://www.koeco.or.kr/eng/business/business01_01.asp?search=1_1)

#### *Environmental Declaration of Products (EDP) Program*

The EDP Program is National type III environmental declaration program to disclose quantified environmental impacts information on the life cycle of a product, including production, distribution, consumption, and disposal. It is introduced to guarantee the reliability of environmental information of products. The Program is administered by KOECO.

See: [http://www.koeco.or.kr/eng/business/business02\\_01.asp?search=2\\_1](http://www.koeco.or.kr/eng/business/business02_01.asp?search=2_1)

#### *Other initiatives by KOECO*

KOECO also manages a number of other initiatives promoting sustainable production and consumption, such as: operating the Eco-Supply Chain Management Network (involving such industries as steel, pulp and paper, the automobile industry) and the Trade & Environment Information Network, providing the Eco-Design technical assistance service, organising Eco-Products Exhibition, etc.

#### *Kids ISO 14000 Program*

The Kids ISO 14000 Program is an international project designed to stimulate environmental awareness among children and to take practical steps to preserve the environment. It involves one

hundred elementary school students, who learn about various energy saving methods and waste recycling processes. The programme is run by the Agency for Technology and Standards (Kats)<sup>76</sup>.

See: [www.iso.org/iso/en/kidsiso14000/index.html](http://www.iso.org/iso/en/kidsiso14000/index.html)

#### *Energy Efficiency Labelling Program*

The Energy Efficiency Labelling program, run by KEMCO, aims to save energy by enabling the consumers to identify the high efficiency energy saving type products and encouraging the manufacturers/importers to produce and sell energy saving products.



See: [http://www.kemco.or.kr/english/sub03\\_energyefficiency.asp?defmenu=3](http://www.kemco.or.kr/english/sub03_energyefficiency.asp?defmenu=3)

#### *Energy Conservation Month/Day*

Each year November is the month designated by the government as the 'Energy Conservation Month'. In this month various events are held to draw the attention of the public toward energy conservation. Furthermore, the first Fridays of each month are designated as 'Energy Conservation Day'<sup>77</sup>.

#### *Energy Conservation Exhibition and Convention*

The Energy Conservation Exhibition (ENCONEX) has been annually organized by KEMCO since 1975 to promote the latest energy conservation technologies and equipment. The Energy Conservation Convention is held annually to heighten public energy conservation awareness<sup>78</sup>.

#### *Korea Environmental Technology Awards*

Korea Environmental Technology Awards, hosted and organized by MOE and Kiest since 1995, is a ceremony to identify and reward persons who made notable contribution to environmental improvement by developing or commercializing excellent environmental technology or products. It aims to promote environmental technology development in private sector and encourage creative technology development efforts.

<sup>76</sup> Source: <http://www.iea.org/Textbase/pm/?mode=pm&id=2384&action=detail>

<sup>77</sup> Source : [http://www.kemco.or.kr/english/sub03\\_other03.asp?defmenu=7](http://www.kemco.or.kr/english/sub03_other03.asp?defmenu=7)

<sup>78</sup> Source : [http://www.kemco.or.kr/english/sub03\\_other03.asp?defmenu=7](http://www.kemco.or.kr/english/sub03_other03.asp?defmenu=7)

### *National Environmental Technology Information System*

The system was launched by MOE in 2000 to stimulate and promote development of innovative environmental technologies and its implementation. In addition, it also aims to foster environmental industries technologies and encourage creative technology development efforts. Through the Information System, MOE has been providing information on the latest technology to people in environment-related sectors. Currently, it has established some 43,000 databases at 14 DB such as information on technical support and information on planning and construction.

### *Environmentally friendly Company Certification System*

Through the Environmentally Friendly Enterprise Certification System, companies are recognized on the basis of performance and employee participation in proper treatment of pollution from the company, as well as precautionary environmental management and environmental improvement efforts. Introduced in April 1995, a total of 146 companies were designated in the year 2003.

Certified companies can increase information exchange with each other and strengthen capacity to provide technology support and consulting to small and medium sized enterprises (SMEs) through the nationwide online network ([www.ef21.co.kr](http://www.ef21.co.kr)) established in 2001, led by the Korean Association of Environmentally Friendly Enterprises. In addition, certified companies play key roles in relation to the environmental management know-how being developed and distributed by MOE such as environmental reporting, performance review and accounting.<sup>79</sup> See: <http://www.ef21.co.kr/english/index.htm>

*Achievements:* the System has awarded 137 companies by 2003.

### ***Acting Globally***

International projects on eco-innovation include:

- Korea-China Environmental Industry initiatives
- Environmental Industry Round-Tables
- APEC Expert Groups
- KEMCO bilateral collaborations
- Clean Development Mechanisms (CDM)

KOECO also cooperates with international agencies such as GEN (Global Eco-labelling Network), GEDnet (Global Type III Environmental Product Declarations Network) and IGPN (International Green Purchasing Network) and signed Mutual Recognition Agreements (MRA) with six countries including Japan and China.

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<sup>79</sup> [http://eng.me.go.kr/docs/common/common\\_view.html?idx=34&av\\_pg=1&mcode=10&classno=15](http://eng.me.go.kr/docs/common/common_view.html?idx=34&av_pg=1&mcode=10&classno=15)

*Korea-China Environmental Industry initiatives*

Environmental cooperation with China is especially active in the field of environmental industry, with jointly run 'Korea-China Environmental Industry Centers,' pilot projects in 10 selected provinces and cities<sup>80</sup>. In July 2002, the Korea-China Environmental Industry Investment Forum was organized in China to present Korean environmental industries and technologies.

In July 2001, Korea established the Korea Environmental Technology Exhibition Center in Beijing, China. The center exhibits environmental technologies of sixteen Korean companies and provides a collection of Chinese market research<sup>81</sup>.

*Achievements:* about US \$2 billion of exports were achieved by twenty environmental companies in Korea.

*Environmental Industry Round-Tables*

Korea, China and Japan organized environmental industry round-tables to boost environmental industry cooperation<sup>82</sup>.

*APEC Expert Groups*

KEMCO has joined the APEC (Asia-Pacific Economic Cooperation) Expert Groups on Energy Efficiency & Conservation and New & Renewable Energy Technologies and produced numerous innovations<sup>83</sup>.

KEMCO maintains close relations with other associated organizations abroad to exchange energy information and develop collaborative programs such as joint-seminar, training or research projects. Its main partners are ECCJ, NEDO, DOE, LBNL, DENA, NREL, ADEME, NOVEM, ENEA, SEDA and FES<sup>84</sup>.

*Clean Development Mechanisms (CDM)*

The Korean government funds approximately \$1 billion a year to finance energy saving and conservation projects. MOE and MKE promote and support the development and commercialisation of GHG reduction technologies which may be considered as CDM projects. A number of CDM projects in renewable energy such as landfill gas power generation, energy efficiency are already in practice and actively being discussed with overseas investors<sup>85</sup>.

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80 [http://eng.me.go.kr/docs/common/common\\_view.html?idx=33&mcode=10&av\\_pg=1&classno=15](http://eng.me.go.kr/docs/common/common_view.html?idx=33&mcode=10&av_pg=1&classno=15)

81 [http://eng.me.go.kr/docs/common/common\\_view.html?idx=35&av\\_pg=1&mcode=10&classno=15](http://eng.me.go.kr/docs/common/common_view.html?idx=35&av_pg=1&mcode=10&classno=15)

82 [http://eng.me.go.kr/docs/common/common\\_view.html?idx=8&av\\_pg=1&mcode=30&classno=14](http://eng.me.go.kr/docs/common/common_view.html?idx=8&av_pg=1&mcode=30&classno=14)

83 Source : [http://www.kemco.or.kr/english/sub03\\_int02.asp?defmenu=6](http://www.kemco.or.kr/english/sub03_int02.asp?defmenu=6)

84 [http://www.kemco.or.kr/english/sub03\\_int.asp?defmenu=6](http://www.kemco.or.kr/english/sub03_int.asp?defmenu=6)

85 Source : <http://www.iea.org/Textbase/pm/?mode=pm&id=969&action=detail>

## Country Synthesis

### *Eco-innovation and national competitiveness*

Korea explicitly identifies innovation at large, and eco-innovation more specifically, as a vehicle to increase economic growth and national competitiveness.

Initially, Korea's national science and technology policies focused mainly on the introduction, absorption, and application of foreign technologies. In the 1980s, the emphasis shifted to the planning and conducting of national R&D projects to raise the level of scientific and technological skills, using G7 countries as a benchmark. In 2003, the government placed science and technology at the top of its policy agenda to spur economic growth. In 2004, the government announced a plan to restructure the National Innovation System (NIS). The plan emphasizes shifting from a catch-up model to a more innovation-driven one. At the same time, Korea committed to strengthen its involvement in global issues, such as the preservation of the environment<sup>86</sup>.

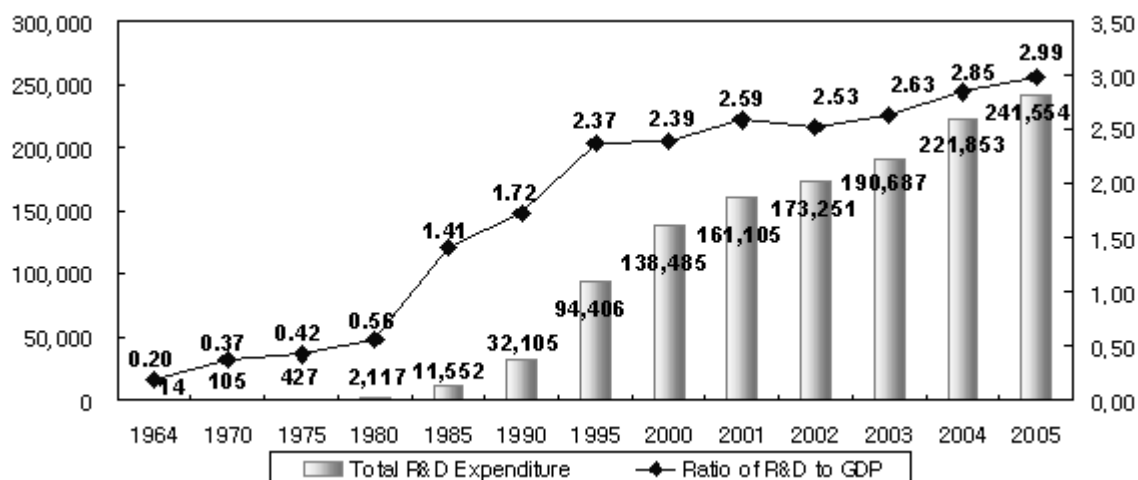
The total R&D expenditure in the field of science and technology (natural sciences, engineering, agriculture, animal husbandry, fisheries, medicine, pharmacy, etc.) for the year 2005 in Korea was 24,155.4 billion won, showing an increase of 8.9% from the previous year. In 2005 R&D expenditure as a percentage of Gross Domestic Product (GDP) was 2.99% - among the highest worldwide. This equals the EU target for R&D expenditure set by the EU Lisbon Strategy, namely 3% of GDP by 2010. as many Korean firms are reaching knowledge frontiers across several sectors, government has increased its spending on R&D, at a rate more than twice OECD average (see OECD, forthcoming). However, the OECD Review points at some limitations in the efficiency of public R&D spending in Korea: duplication between universities and government research institutes, or between government programmes and projects, weak linkages between business, university and government research institutes have to be remedied, to enhance the transition from a catch-up model of technological progress to a more creative approach. More support to SMEs, emphasis on service industries, and diversification in research areas are important directions for innovation policies in Korea.

A number of projects have been financed in the past 20 year to improve, among others, environmental technologies. Among these, the most noteworthy are the *G7 Project*, followed by the *Eco-Technopia* – the latter more focused on specific areas, like environmental conservation and pollution prevention.

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<sup>86</sup> [http://www.korea.net/korea/kor\\_loca.asp?code=E0207](http://www.korea.net/korea/kor_loca.asp?code=E0207)

Figure 4. Trend of R&amp;D expenditure and ratio of R&amp;D to GDP



Source : MOST (<http://www.most.go.kr/en/sce05/sce0501/sce050101/>)

#### *Creating markets*

Several initiatives promote eco-innovation. Funding seems to have shifted from research and development towards the deployment and commercial phase, with several measures stimulating demand through market-based instruments and awareness raising. Labelling and standardisation and technology verification also play an important role in supporting the development of a market for eco-innovation; the harmonization of eco-labelling systems across East Asia provides opportunities to enhance their impacts.

#### *Working with industry and the finance community*

Several initiatives are based on voluntary approaches, such as the *Voluntary Agreement*, the *Eco-labelling*, the *Voluntary Fuel Efficiency Standards* etc. An interesting mix of voluntary and mandatory approaches is represented by the *Stand-By Korea* program, which sets voluntary targets at the early stages, to become mandatory at the end of the program.

Korea is keen to promote its technologies abroad, and to exchange information with other countries. In particular, the collaboration between Korea and China on environmental industries is active, with initiatives such as the *Korea-China Environmental Industry initiatives*, the *Korea Environmental Technology Exhibition Center* in Beijing, and the *Environmental Industry Round-Tables* (which include Japan).

Korea has set up initiative to encourage venture capital in green technologies. The performance of the Environmental Venture Fund and of the Environmental Technology Business Incubator (ETBI) deserves a particular analysis.

#### *Regional coordination to address local issues*

The *Regional Environment Technology Development Centres* are interesting examples of cooperation between administrative agencies, research institutes, industries and non-governmental organizations, centred on universities. The responsibilities of each centre (about 16 in 2006) include

identification and analysis of local environmental pollution, development of environmental technology, environmental education and technical support to enterprises coping with environmental management problems, and dissemination of new environmental technologies. Environmental education programs are also being administered, including courses for environmental managers and citizens and joint seminars among industries, research institutes and academic communities.

## Appendices

### *Summary table*

Actions	Initiatives
Research and Development	21st Century Frontier R&D Program Core Environmental Technology R&D Program for next generation National Research Laboratory (NRL)
Verification of Technology	Environmental Technology Verification (ETV) Program Integrated Energy Policy (IEP) Mandatory Energy Audits for Large Power Consumers
Performance Targets	Rational Energy Utilisation Plan - 2004 Building code standards Standby Korea 2010 Voluntary Fuel Efficiency Standards Energy Efficiency Labelling Program
Mobilisation of Financing	G7 Project (Leading Technology Development Project) Eco-Technopia 21 Project Eco-STAR (Eco-Science & Technology Advancement Research) Demonstration & Dissemination Program Environmental Venture Fund
Market-based Instruments and State Aid	Feed-in Tariff for Renewables (Electricity Business Law) Voluntary Agreement (VA) Tax Incentives Loans Hybrid and Fuel-Cell Powered Vehicles Plan
Labelling and Procurement	Eco-labelling Program Environmental Declaration of Products (EDP) Program Other initiatives by KOECO Act on the Promotion of the Purchase of Environment-friendly Products
Awareness Rising and Training	Kids ISO 14000 Program Energy Conservation Month/Day Energy Conservation Exhibition and Convention National Environmental Technology Information System Environmentally friendly Company Designation System Corporate Environmental Information Disclosure System
Acting Globally	Korea-China Environmental Industry initiatives Korea Environmental Technology Exhibition Center Environmental Industry Round-Tables APEC Expert Groups KEMCO bilateral collaborations Clean Development Mechanisms (CDM)
Others	Act on the Promotion of the Development, Use and Dissemination of New and Renewable Energy

### *Eco-industries in Korea*

After the 1990s, Korea unveiled a gradual development of the environmental industry in accordance with growth in public awareness and governmental efforts toward environmental protection. The ministry of the Environment has also been working towards promoting joint environmental industry development and exchange, especially with China and other Northeast Asian countries<sup>87</sup>.

Between 1995 and 2005 the environmental industry in Korea has grown by 13.4 percent annually. In 2005 the green industry was worth more than 20,000 billion won (see Table 2 below), and is expected to grow to about 28,000 billion by 2015.

**Table 2. Trends in environmental industry**

unit: 1000 billion Won, %

Domain	1995	2005	2015	Annual growth rate 1995-2005	Annual growth rate 2005-2015
Water	2.89	8.23	8.49	11.0	0.3
Air pollution	1.08	3.46	4.24	12.3	2.1
Waste	1.70	5.06	5.66	11.5	1.1
Soil	0.20	1.50	3.11	22.3	7.6
Service	0.04	2.58	6.79	50.1	10.1
Total	5.92	20.84	28.30	13.4	3.1

Source : 21st Century Environmental Technology Development Plan, 1997, NIER, Korea

The industry remains essentially small businesses (70% have capital under 1 million USD). They are essentially focusing on end-of-pipe technologies.

<sup>87</sup> [http://eng.me.go.kr/docs/common/common\\_view.html?idx=35&av\\_pg=1&mcode=10&classno=15](http://eng.me.go.kr/docs/common/common_view.html?idx=35&av_pg=1&mcode=10&classno=15)

***Reference and data sources***

References are noted as footnotes in the text. In addition, the following documents and web sites have been consulted:

European Commission, 2004: Overview of Existing Environmental Technologies Evaluation/Verification Programs

[http://ec.europa.eu/environment/etap/pdfs/overview\\_env techno verification.pdf](http://ec.europa.eu/environment/etap/pdfs/overview_env techno verification.pdf)

OECD (forthcoming), Review of Korea's Innovation Policy

United Nations, 1999: Compendium on Energy Conservation Legislation in Countries of the Asia and Pacific Region

<http://www.unescap.org/esd/energy/publications/compend/cec.htm>

Ministry of Environment, 2005: Korea Environmental policy Bulletin, Issue 2, Volume III, 2005

[http://www.kei.re.kr/04\\_publ/pdf/others/KEPB2005\\_2.pdf](http://www.kei.re.kr/04_publ/pdf/others/KEPB2005_2.pdf)

Web sites : <http://www.iea.org/Textbase/pm/>

## COUNTRY PROFILE OF MEXICO

### Introduction and country definitions of eco-innovation

#### *Definitions related to eco-innovation used in the Country*

No straightforward definition of eco-innovation has been found in the document reviewed. The Mexican government is committed to increase the country's competitiveness through innovation and technology efforts, and this is reflected in several official documents. However, the concepts of 'environmental innovation', 'clean technology' and 'sustainable technology' are not easily identified in the agenda yet.

#### *Institutions playing a major role on eco innovation*

Mexico's innovation system incorporates a wide range of institutions and organisations whose purpose is to foster technology adoption and innovation within Mexican industry. The organisations focus on funding, training, specialised research, and basic science research.

The Information provided in this report is mainly based on initiatives taken by the governmental institutions within the Mexican Government, as even though Mexico is a federal country (with strong federal regions), it has centralised responsibility for innovation in a single agency: the *National Council of Science and Technology (CONACYT)*. CONACYT is indeed the most important public entity promoting and supporting science and technology activities, reporting directly to the President. In addition, the national government also coordinates departments at regional and national level.

#### *National Council of Science and Technology*

CONACYT's main objectives include:

- Setting up funds for scientific and technological research;
- Fostering innovation in the services sector, especially software-related research;
- Establishing links with international organisations, furthering collaboration between national and foreign institutions;
- Administering the postgraduate scholarship system;
- Coordinating the CONACYT System of Research Centres – a set of 27 research centres whose main function is to conduct scientific research and technological development; and
- Administering the National Researchers System (SNI) that seeks to strengthen and stimulate research efficiency and quality by providing support to researchers in higher learning institutions or public sector research centres, as well as to the scientists working for private institutions (OECD, 2004).

CONACYT has launched several initiatives directed to increase the level of technological development in Mexico. Several actions have been implemented in coordination with different Ministries of State, such as *SEMARNAT (the Ministry of Environment and natural Resources)* and the *Ministry of Economics*.

#### *Ministry of Economics*

The Ministry of Economics operates the national Committee on Productivity and Technological Innovation, which is designated to improve the competitive position of small and medium-sized enterprises by maximizing the use of their resources.

There is a special fund co-managed by SEMARNAT and CONACYT to promote technological projects in environmental issues. But estimations report that only three of the 120 projects supported in 2003 regarded environmental innovations applicable to industry (Lopez, 2004).

#### *National Commission for Energy Conservation*

Since its creation in 1989, *Mexico's National Commission for Energy Conservation (Comision Nacional para el Ahorro del Energía, CONAE)*, the energy conservation arm of the Energy Secretariat (SENER), has had a governmental mandate to provide technical assistance on energy efficiency to the public sector.

#### *State Councils on Science and Technology*

While still fairly centralised, the Mexican innovation system has recently increased State's autonomy. For instances, up to 2004, 23 out of the 32 States in Mexico established their State Councils on Science and Technology (e.g. the States of Coahuila, Durango, San Luis Potosí, Querétaro and Tabasco). These councils are a permanent forum to discuss and propose science and technology programmes and actions furthering state-level innovation capacity. The organisations also work to improve researcher and facility cooperation between institutions and researchers in different geographical areas on subjects of common interest (OECD, 2004 and European Commission, 2006).

#### ***Policy documents related to eco-innovation***

The following Mexican legislative and policy programmes enacted in 2000 and 2001 provide a good framework for building a more innovative economy (see Lewis, 2006):

- In 2001, the Fox administration presented its *National Programme for Science and Technology 2001-2006*. The Programme set strategic priorities and guidelines for the development of science, technology and innovation in Mexico and identified broad objectives, such as creating a coherent policy framework for science and technology, increasing Mexico's science and technology capacity, and finding ways to use science and technology to increase innovation in the private sector. Clear goals have been set for each of these objectives and the timeline for achieving the same has been set for 2006. The Program is part of the Mexican National Development Plan which aims to drive responsible economic growth in the nation, elevate and extend the country's competitiveness, ensure inclusive development, promote balanced regional economic development, and create conditions for sustainable development (European Commission, 2006).
- On April 30, 2002, Mexico revised its legal framework for science and technology by approving the *Science and Technology Bill (Ley de Ciencia y Tecnología - LCYT)*, to

further strengthen and develop general scientific and technological research in the country. The Law created new mechanisms to support scientific research and technology. These included: (i) modifying the way CONACYT operates (e.g. making CONACYT a separate agency that report directly to the President); (ii) establishing several new coordinating bodies (e.g. National Board of Support to Scientific and Technological Activities, National Board of Support to Competitiveness, and National Council of Assessors on Science and Technology); (iii) establishing a separate budget function for CONACYT and creating new funding mechanisms for federal and mixed (combined federal, state, and local) funding; and (iv) creating tax incentives to subsidize private R&D for approved companies (a tax credit equal to 30 percent of the annual research spending), among others.

In recent years there have been larger programmes of reforms, and some relevant policy document in respect to eco innovation include:

- ‘Towards a national Climate Change Strategy’ in 2006 and ‘National Climate Change Strategy’; these strategic documents, released in 2007 by Mexico’s Interministerial Commission on Climate Change (ICCC), signal the government’s effort to increase the use of renewable energy. ICCC was active in introducing legislation and projects associated with renewable energy sources (Banda et al., 2007).
- During 2006, federal government attention was focused on the Renewable Energy Law, which specifies a range of transmission conditions to better capture the electricity generated from renewables. It also facilitates the connection of privately operated renewable energy sources to the national grid, and supports the development of emerging technologies based on renewable energy sources. Further, the bill proposes the implementation of a trust fund to assist research and development activities focused on those renewable energy technologies considered most promising. The Renewable Energy Law has been criticized because while it authorizes incentives to promote the use of renewables, the law is vague and ambiguous about the type of incentives that will be used.

Such decisions will be left largely to the Ministry of Energy, SENER. SENER will manage a trust for grant requests (*Fideicomiso para el aprovechamiento de fuentes renovables de energía*), although the total size of the trust is unclear. The Lower House indicated that funding would be drawn from a number of sources, including federal appropriations, unidentified duties, contributions from state governments and municipalities, voluntary contributions by individuals and companies, contributions by international organizations, and proceeds from the sale of renewable energy certificates to individuals or entities in Mexico and abroad. Final approval of Renewable Energy Law has been delayed (Banda et al, 2007).

- In May 2007 President Felipe Calderon proposed the 2007-2012 National Development Plan for Mexico, which emphasizes the country’s commitment to sustainable development.

## **Policies, Initiatives and instruments – a national inventory**

### ***Research and Development***

The general goal of CONACYT is to bolster investment in R&D that will result in higher standards of living, to be achieved through stronger higher education programmes in science and technology, support for research initiatives, and the diffusion of innovation. Specifically, CONACYT supports graduate students in domestic and foreign programmes of demonstrated quality; supports firm-based innovation and the facilitation of industry-academia linkages; and bolsters the R&D

regional development and scientific network. CONACYT also operates 28 centres across the country that research technology, engineering, basic science, and social science (European Commission, 2006).

In order to facilitate technology transfer by universities and public laboratories, some of these institutions have been designated as Public Research Centres. These centres have been given the freedom to manage the technologies that they develop as well as resources that they generate. During the past ten years, major universities have forged links with private industry, resulting in a growing number of innovative programmes in education, training, research, and technology development. Much of the effort is channelled through Centres of International Competitiveness and Centres of Advanced Technology on different campuses throughout the country. Furthermore, initiatives currently under review at various universities, if passed, would give researchers who worked on innovations developed at these institutions a share of the economic rewards of the innovation. Furthermore, cooperation agreements allow public institutions and private enterprises to share intellectual property rights. Enterprises requesting the support of the higher learning institutions may even wholly own property rights in some cases (European Commission, 2006).

### ***Verification of technologies***

The *Administración Pública Federal* (APF) initiative was developed by CONAE, the National Commission for Energy Conservation, in 1999, as an extension of the “100 Public Buildings” pilot program, which began in the early 1990s (see under ‘Awareness raising and training’). APF applies to all Mexican federal agencies and to date, APF has resulted in energy audits and retrofits (mainly for lighting) in almost one thousand Mexican government buildings.

### ***Performance Targets***

The National Commission for Energy Conservation (CONAE) has developed a number of energy efficiency standards and programmes. CONAE also promulgated official national mandatory regulations for energy efficiency (NOMS) of all new products and appliances (e.g. air conditioners). The ‘National Climate Change Strategy’ adopted in 2007 by Mexico’s Interministerial Commission on Climate Change (ICCC) reports the government’s intention to expand this strategy.

The ‘National Climate Change Strategy’ launched in 2007 by Mexico’s Interministerial Commission on Climate Change (ICCC) includes several initiatives that fall in this category, such as (i) increasing PEMEX’s energy efficiency target by 5%; (ii) increasing efficiency of flares on offshore platforms; (iii) increasing the efficiency of transmission and distribution lines by 2%; (iv) increasing thermal efficiency of fuel oil-fired thermoelectric plants by 2%; among others.

### ***Mobilisation of Financing***

In an effort to encourage private sector innovation, the Mexican government has been offering companies tax credits for R&D since 1998. Up to the year 2000, the incentive consisted of a 20 percent tax credit of the eligible expenditures and investments in research and development of technology (IDT) that the company would incur during a certain fiscal year. However, starting in 2001, the benefits were further increased. Companies now get a tax credit equal to 30 percent of their annual IDT expense, regardless of size or industrial sector (European Commission, 2006 and OECD, 2004).

CONACYT also supports technological modernization, linkage and the development of technology through low interest rate loans and “lost fund loans”, where payment of the loan is not required, provided certain previously established conditions are met.

The Mexican Government established “mixed funds” with the objective of establishing specific regional and local programmes, supporting further scientific and technological development and decentralization, and strengthening regional and local research and development capabilities. These funds are set up with joint contributions of the productive, academic and governmental sector, in a proportion which varies for each individual case. Traditionally, most of CONACYT’s resources have stayed in Mexico City. These funds have the additional advantage of promoting decentralisation of research. Mixed funds have been operating since 2001 and up to 2004 26 mixed funds and one municipal fund were set up (OECD, 2004 and European Commission, 2006).

The Mexican Government also established science and technology sectoral funds, which refer only to state Ministries of the Federal Government and to their research centres. Establishing these funds requires making technological diagnosis and forecasts by knowledge areas. In recent years (up to 2004), 14 sectoral funds began operating on several topics of applied research and technological development (OECD, 2004 and European Commission, 2006).

Electrical Energy Savings Trust (FIDE) developed a successful refrigerator and air conditioner substitution program allowing consumers finance credits for purchasing and using more energy efficient appliances in areas where electricity is provided by CFE, replacement of nearly 20% of all incandescent lamps in residential buildings with longer lasting compact fluorescent lamps, and financing industries which exchange inefficient equipment for more energy saving models. This was in addition to projects aimed at increasing the use of energy-efficient technologies and practices in government buildings and beginning in residential sectors as well (Banda et al, 2007).

Implementation of the Mexican Carbon Fund (FOMECAR), created as a result of the joined efforts of the Ministry of Environment and Natural Resources of Mexico, Centro Mario Molina, and the Mexican Bank for Foreign Trade (BANCOMEXT) in order to provide Mexican companies and public entities with technical and financial support to develop Clean Development Mechanism (CDM) projects. The fund became fully operational at the end of 2006 and is currently managed and run by the Mexican Bank of Foreign Trade. Since July 2006, 52 new projects were registered in Mexico under the CDM established by the Kyoto Protocol, in partnership with Switzerland, the Netherlands, the UK, Japan, and Spain (Banda, 2007).

‘AVANCE’ (a Spanish word for “advance”) is a programme that seeks to produce “High Value-Added Businesses linking Knowledge with Visionary Entrepreneurs”. The programme was developed by CONACYT to advance technological innovation in the private sector. It works as a kind of venture-capital effort and provides support for researchers, entrepreneurs, companies, and research institutions who wish to commercialise their research, by transforming scientific and technological developments into commercial activities (Lewis, 2006). The focus sectors include information technology, electronics and telecommunications, health, agricultural, fishing and food development, advanced materials, sustainable development and environment, energy, design and manufacturing, housing and construction, attention to poverty and social needs (OECD, 2004).

### ***Procurement***

Initiatives related to green procurement include the following ones.

In 2000, PEPS and CONAE, the National Commission for Energy Conservation, began a programme to promote energy-efficient purchasing by national government agencies in Mexico (see under ‘Acting Globally’). The idea was to take advantage of the momentum of the APF program (see under ‘Verification of Technologies’), which was demonstrating considerable success in generating audits and lighting retrofits in large government buildings. PEPS aimed to get APF-participating agencies and facilities to institute procurement policies that, as a complement to the retrofit projects, would commit them to buy energy-efficient products in their day-to-day purchasing. However, the effort to launch a full-blown initiative at the federal level was not successful.

Subsequently, it was decided to shift to a more decentralized, bottom-up strategy targeting municipal government purchasing, through a collaboration established in 2003 with ICLEI. The pilot phase of the municipal program focused on cities’ purchases of a limited set of energy-efficient products (lighting and office equipment) that qualified for either the Sello FIDE (Mexican) endorsement label or the US-based ENERGY STAR label. During 2004, PEPS developed procurement specifications for the pilot-phase products and provided eight pilot municipalities with training and technical assistance on buying energy-efficient products. In 2005, PEPS continued to work through ICLEI and a Mexican municipal association, AMMAC (Asociación de Municipios de México AC), to provide individualized technical assistance to the pilot municipalities. The specific objectives were to ensure that each municipality adopted procurement policies that included the energy-efficient specifications, and to assist in their initial purchases of energy-efficient products. By September of 2005, \$1 million in estimated PEPS-related purchases had been made by four municipalities. The estimated annual savings from these purchases exceeded 5,000 MWh. By early 2006, seven of the eight PEPS pilot cities had begun buying energy-efficient products according to the PEPS recommendations. Furthermore, two of the cities had adopted new purchasing policies and policies were nearing completion in five other cities. PEPS expects to expand the programme and further collaborate with CONAE to transform the energy-efficient procurement program into a mandatory policy for all federal agencies (Van Wie McGrory et al., 2006 and Lawrence Berkeley National Laboratory, 2007).

The Ministry of Environment and Natural Resources has taken an initiative to incorporate forest certification in the criteria of public procurement at federal and state level (ITTO, 2005).

The Commission for Environmental Cooperation involves the governments of the US, Canada and Mexico and aims to build North American markets for renewable energy and other green products, and to facilitate green trade through ecolabeling and green purchasing. The Commission serves as the Secretariat for the North American Green Purchasing Initiative, a clearinghouse of information for manufacturers, purchasers, and suppliers. The initiative has highlighted the business case for green procurement. In a report dated 2005 it indicated that Governments and companies are buying green because it results in benefits such as reducing overall costs, the opportunity to use materials more effectively, improving employee health and stimulating markets for innovative new products and services (Australian National Audit Office, 2005).

### ***Awareness raising and training***

#### *The Mexico GHG Programme*

This programme is coordinated by SEMARNAT, with a technical support from the World Resource Institute and the World Business Council for Sustainable Development. The GHG Programme is advised by a committee of experts from local NGOs (e.g. the Centre of Public Policy for Sustainable Development and the Private Sector Commission for Sustainable Development), local business and industry associations (e.g. the National Confederation of Industrial Chambers of

Mexico), and government environmental agencies (e.g. the National Institute of Ecology and the Registry for the Emission and Transference of Pollutants). Initially launched on 25 August 2004, the GHG Pilot Programme aimed at developing a two years voluntary reporting platform on greenhouse gases emissions for Mexican businesses. Currently, the GHG Programme partners organize training workshops and provide information, calculation tools, and technical assistance to participants (i.e. private and public-sector organizations operating in Mexico) for preparing corporate GHG inventories, identifying GHG reduction opportunities, and participating in GHG markets (Banda et al., 2007).

#### *The Centre on Sustainable Consumption and Production*

The Centre on Sustainable Consumption and Production (CSCP) and Ö-Quadrat (Freiburg) developed a pilot project at the National Autonomous University of Mexico (UNAM) to refit inefficient T 12-lamps installed in two of the university's buildings with new lighting equipment. The project aimed at demonstrating the potential for energy savings, and how improved illumination could improve learning conditions and reduce maintenance costs. The project included communication measures to inform students and faculty members about efficient illumination. Based on this pilot project, CSCP will develop a best practice handbook for application in the Mexican context, and will organise workshops and seminars. Furthermore, a publication with best practice cases developed at international level, including the Mexican one, will be developed and presented in international forums (UNEP/Wuppertal Institute Collaborating Centre on Sustainable Consumption and Production, at <http://www.scp-centre.org/HOME.786.0.html> ).

#### *100 Public Buildings and the programme of Energy Savings in Federal Buildings*

Based on a programme launched in the early 1990s of energy studies and audits in different sectors, CONAE, the National Commission for Energy Conservation, developed a voluntary pilot programme entitled '100 Public Buildings', aiming to increase energy efficiency in federal buildings. As part of the programme, CONAE provided training and technical assistance to building operators, whose personnel eventually acquired the theoretical and practical knowledge to conduct their own assessments under the supervision of CONAE staff. The operators also were trained in follow-up measures, including permanent monitoring of energy use, and operation and maintenance of the newly installed equipment.

By 1998, after assessing 90 buildings (800 thousand square meters and 135 thousand lights), CONAE concluded that if all the recommended measures were implemented, a total demand reduction of 21% could be achieved – equivalent to 19 GWh per year, or 3.5 MW of avoided generating capacity. The estimated investment of US\$1.5 million would be recovered in 17 months. The programme showed the value of targeting two types of energy saving measures: technological, to upgrade or replace obsolete equipment, and operational, to improve the use of existing equipment with little or no capital cost (McGregory, 2002).

The "100 Public Buildings" programme was a precursor to the larger-scale Programme of Energy Savings in Federal Buildings (APF), which was applied to entire federal government.

#### *Regional Liaison Units for Energy Efficiency*

In 1993, CONAE started providing technical assistance through regional delegations called 'Liaison Units for Energy Efficiency' (U3Es). In an early stage, the U3Es promoted energy efficiency by visiting a limited number of industrial and commercial facilities to perform energy audits, sometimes followed by more comprehensive studies to identify specific energy saving measures.

In 1997, CONAE set out a new strategy based on the use of internet to widen the reach and scope of technical assistance activities, named “Virtual CONAE”. This initiative aimed to: a) link U3Es and their customers to other research centres, energy efficiency offices, and financing institutions, in Mexico and worldwide; and b) provide on-line technical assistance in the form of updated economic and technical information as well as software tools for evaluating energy efficiency projects. CONAE developed an executable program (SIAPF) to facilitate the process of evaluating lighting systems and identifying energy-saving measures.

As part of the ‘Virtual CONAE’ strategy, ‘Ports of Attention’ (PACs) were developed to assist potential users (i) who did not have access to the Internet (many small firms and some offices of municipal governments), and (ii) who found it difficult to use the on-line tools. The PACs are typically located in educational institutions, industrial and commercial chambers, or government agencies. They are very low-cost technical assistance units, which require only a computer connected to the Internet and a trained operator. Their basic function is to assist energy users in identifying energy savings potential and evaluating the economic feasibility of specific measures. A number of PACs now concentrate on industrial sector energy efficiency; others deal more with state and municipal energy issues; and some address relationships between energy and the environment (McGregory et al., 2002).

*The National Committee on Productivity and Technological Innovation programme and the Technological Services Information System programme*

The Ministry of Economics, together with the CONACYT, operates the National Committee on Productivity and Technological Innovation (COMPITE) programme and the Technological Services Information System (SISTEC) programme. The COMPITE Programme is designed to improve the competitive position of SMEs (micro-, small- and medium-sized enterprises), maximizing the use of their resources. It is a methodology for fast intervention, mixing theory and practice to solve production problems, and applicable in all branches of industrial manufacturing.

The objective of SISTEC is to build the technological awareness of SMEs and to provide them with information from Applied Research and Technological Development Centres and Institutes. This helps build links between technological research and private enterprise, contributing to modernisation and improved competitiveness. The SISTEC is an open access information system that only provides information on technological centres and consultants throughout the country. The cost for the services provided by the centres or individual consultants varies depending on the policies of each one of them (OECD, 2004 and European Commission, 2006).

***Acting Globally***

Mexico and the United States celebrated a Science and Technology Agreement back in 1972. This agreement, which has been rather underused so far, can provide a framework for an expanded cooperation among the two countries.

Furthermore, the North American Free Trade Agreement (NAFTA), which came into effect in 1994, brought a set of negotiations related to environmental issues under the North American Agreement of Environmental Cooperation (NAAEC) (Lopez, 2004).

Since the adoption of the North American Free Trade Agreement (NAFTA), there have been strong integrative forces between Mexico, United States and Canada. Initiatives include:

- Commission for Environmental Cooperation (CEC): this is an international organization created by Canada, Mexico and the United States under the North American Agreement on

Environmental Cooperation (NAAEC). The CEC was established to address regional environmental concerns, help prevent potential trade and environmental conflicts, and to promote the effective enforcement of environmental law. Among its programs and projects, it helps identify opportunities for cooperation and trade in environmental goods and services including renewable energy and energy efficiency;

- The United States, Canada, and Mexico have joined forces to create a high-tech business alliance among the Canadian Advanced Technology Alliance (CATA), the United States' Software and Information Industries Association (SIIA), and Mexican high-tech association Canietti. There is a high level of trade between the countries' technology industries. For instances, in 2004, Canada and Mexico were the United States' largest export markets for information and communications technologies. The alliance intends to launch many joint programmes including a joint facility in China (European Commission, 2006).
- In 2007, Canada, Mexico and United States signed a Trilateral Agreement for Cooperation in Energy Science and Technology to fuel joint developments to seek cleaner and more efficient ways to use energy<sup>88</sup>.
- Two major projects have already been launched with funding assistance from the World Bank. The World Bank's Board of Directors approved a US\$25 million grant from the Global Environment Facility (GEF) for Mexico, in order to remove barriers to the development of renewable energy technologies and markets. The World Bank's Large-Scale Renewable Energy Development Project will assist Mexico in developing initial experience in commercially-based, grid-connected renewable energy applications. It will do so by supporting the construction of an approximately 101 MW independent power producer wind farm, designated as La Venta III, which will build on the Federal Electric Commission's 2 MW demonstration plant (La Venta I) and the 85 MW La Venta II. In October 2006, the World Bank also announced funding for a \$50 million Hybrid Solar Thermal Power Plant Project: The Solar Thermal Project Agua Prieta II seeks to demonstrate the benefits of integrating a solar field with a large conventional thermal facility, contribute to reducing the long-term costs of the technology, and reduce global GHG emissions. The total emissions reduction over the 25-year operation of the plant is estimated at 391,270 tons of CO<sub>2</sub> (Banda et al., 2007).
- Science and Technology Working Group in the US-Mexico Binational Commission. Bilateral relations have been reenergized in the last few years, and a large number of groups have been created under the umbrella of the commission focusing on a number of subjects, including pollution (Lewis, 2006).
- Sandia National Laboratories (SNL), supported by United States Department of Energy (USDOE) Office of Solar Technologies and the Mexico mission office of the United States Agency for International Development (USAID) have developed a Renewable Energy Programme to promote the use of renewable energy technologies in Mexico, in order to: (1) increase the quality and to reduce the costs of renewable energy technologies (components, systems, and services) by expanding markets for, and providing feedback to, the U.S. and Mexican renewable energy industry; (2) reduce greenhouse gas emissions and pollution; and (3) increase the economic, social, and health standards in rural, off-grid households and communities by utilizing renewable energy systems for productive applications. The Mexico

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<sup>88</sup> See [http://www.nrcan.gc.ca/media/newsreleases/2007/200766a\\_e.htm](http://www.nrcan.gc.ca/media/newsreleases/2007/200766a_e.htm)

Renewable Energy Program focuses on photovoltaics and small wind electric systems, for rural, off-grid productive applications ([www.re.sandia.gov/index.html](http://www.re.sandia.gov/index.html)).

- Mexico is a member of the international Carbon Sequestration Leadership Forum, although it is not currently pursuing any projects to implement carbon sequestration (Banda et al., 2007).
- PEPS ('Promoting an Energy-Efficient Public Sector') is an initiative from Lawrence Berkeley National Laboratory (LBNL) established in 2000 in collaboration with Alliance to Save Energy, ICLEI – Local Governments for Sustainability, and the International Institute for Energy Conservation (IIEC). With funding support from the U.S. Agency for International Development (USAID), U.S. Department of Energy (U.S. DOE), U.S. Environmental Protection Agency (USEPA), and the Energy Foundation, the PEPS partners develop and disseminate global outreach tools (e.g., a website, guidebook, and energy savings estimation spreadsheet) and work with partner countries to implement government sector energy-efficiency programs at the municipal, state, and national levels. PEPS is currently working to compile a comprehensive inventory of public sector energy management programmes that are being carried out around the world (see: [www.pepsonline.org](http://www.pepsonline.org)). Initiatives implemented in Mexico include: CONAE's APF building retrofit programme (see under 'Awareness raising and training') and EE Product Purchasing (see under 'Procurement').
- Canada is looking into collaboration with Mexico on emissions trading.

### ***Other instruments for innovation***

Metrorrey director Rolando Valle announced that the Monterrey subway system will become the first subway system in Latin America to run on biofuel. The subway system in Mexico's third-largest city serves 180,000 commuters a day. It will switch from electricity to biofuel for 82% of its energy needs (Banda et al., 2007).

## **Country Synthesis**

### ***Overview of policies and measures***

Since 1990s, Mexico has sought to advance its science and technology base by launching a series of programmes and initiatives. Many are sponsored by the Mexico's National Science and Technology Council (CONACYT). Mexico has a small but well-qualified core of researchers upon which to build an expanded national innovation effort, and has also created a structure for scientific cooperation that can be expanded to meet the needs of a high-tech, innovation-driven economy. CONACYT has created an effective structure that makes it possible for Mexico to cooperate on science programmes with international bodies, other governments, and other countries' research institutions (Lewis, 2006).

However, Mexico lags behind other economies in research and development. Mexico invests 0.39 percent of GDP in R&D (compare to 2.2 percent as OECD average). The government provides the bulk of the R&D funding: about two-thirds of the national R&D investment comes from public funds. Mexican R&D funds are concentrated in higher education and public-sector research institutions. This means that Mexican companies are not developing new products and services at the same rate as other OECD economies. This is due to a number of factors, but one of the most important seems to be companies' concern over intellectual property (Lewis, 2006).

Some recent reforms are likely to increase investment in eco-innovation. However, there is the need to include in the agenda the coordination of different policy tools to emphasize environmental innovations and clean technology as a national priority.

A summary of the initiatives described in this report is provided in the table below:

Actions	Initiatives
Research and Development	'National Net of Research Groups and Centres' 'National Registry of Science and Technology Institutions and Companies' (RENIECYT) Additional CONACYT's initiatives Centres of International Competitiveness and Centres of Advanced Technology Public Research Centres Programme aiming to promote the sale of solar powered water heaters developed by CONAE
Verification of Technology	The Administración Pública Federal (APF) initiative developed by CONAE
Performance Targets	Energy efficiency standards and programmes developed by CONAE National mandatory regulations for energy efficiency (NOMS) of all new products and appliances promulgated by CONAE Initiatives launched in 2007 under the 'National Climate Change Strategy' by the Mexico's Interministerial Commission on Climate Change (ICCC)
Mobilisation of Financing	Mexican Government offers companies 30% tax credit of the eligible incremental expenditures and investments in research and development of technology (IDT) that the company would incur during a certain fiscal year Low interest rate loans and "lost fund loans" provided by CONACYT Mexican Government established "mixed funds" (promoting decentralisation of research), and also science and technology sectoral funds Electrical Energy Savings Trust (FIDE) programme Mexican Carbon Fund (FOMECAR) 'AVANCE' (High Value-Added Businesses linking Knowledge with Visionary Entrepreneurs)
Procurement	PEPS ('Promoting an Energy-Efficient Public Sector') and CONAE partnership to promote energy-efficient purchasing Forest certification incorporated in the criteria of public procurement at federal and state level Mexico is a member of the Commission for Environmental Cooperation, which serves as the Secretariat for the North American Green Purchasing Initiative
Awareness Rising and Training	'Mexico GHG Programme' coordinated by SEMARNAT Pilot project developed by the Centre on Sustainable Consumption and Production (CSCP) and Ö-Quadrat (Freiburg) at the National Autonomous University of Mexico (UNAM) Pilot programme entitled '100 Public Buildings' developed by CONAE 'Ports of Attention' (PACs), developed by CONAE as part of the 'Virtual CONAE' strategy 'National Committee on Productivity and Technological Innovation' (COMPITE) programme and 'Technological Services Information System' (SISTEC) programme, developed by CONACYT and the Ministry of Economics 'Technological Information and Services' (INFOTEC) Centre, operated by CONACYT National Science and Technology Week "Science in your School" Programme "Atlas of Science" Programme

Actions	Initiatives
Acting Globally	1972 Science and Technology Agreement between Mexico and US North American Free Trade Agreement (NAFTA) Commission for Environmental Cooperation (CEC) formed by Canada, Mexico and the US under the North American Agreement on Environmental Cooperation (NAAEC) North America Working Group on Environmental Enforcement and Compliance Cooperation (Enforcement Working Group) formed by Canada, the US and Mexico under the CEC High-tech business alliance among the Canadian Advanced Technology Alliance (CATA), the United States' Software and Information Industries Association (SIIA), and Mexican high-tech association Canietti Trilateral Agreement for Cooperation in Energy Science and Technology formed by Mexico, Canada and the US Mexico-United States Foundation for Science 'Innovation for Competitiveness Programme' funded by the World Bank 'Mexican Knowledge and Innovation Project' (KIP) supported by the World Bank World Bank's Large-Scale Renewable Energy Development Project World Bank's Hybrid Solar Thermal Power Plant Project U.C. MEXUS, a cooperative arrangement with the University of California which has been duplicated with other US universities Science and Technology Working Group in the US-Mexico Binational Commission Renewable Energy Programme developed by Sandia National Laboratories (SNL), supported by United States Department of Energy (USDOE) Office of Solar Technologies and the Mexico mission office of the United States Agency for International Development (USAID) Mexico is a member of the international Carbon Sequestration Leadership Forum PEPS ('Promoting an Energy-Efficient Public Sector') Science and technology cooperation agreement signed between Mexico and the EU Canada is looking into collaboration with Mexico on emissions trading

### ***Highlights***

#### *Lessons*

Since the adoption of the North American Free Trade Agreement (NAFTA), which came into effect in 1994, there have been strong integrative forces between Mexico, United States and Canada.

Regional cooperation on environmental issues between Mexico, United States and Canada is expected to create a regional market for eco-innovation. The Commission for Environmental Cooperation (CEC) has an important role in this regard: it identifies opportunities for trade in environmental goods and services, including renewable energy and energy efficiency.

In general, many initiatives in Mexico are focused on promoting energy efficiency, particularly relying on energy efficiency targets. The National Commission for Energy Conservation (CONAE) has put a significant amount of work on the development of these targets. In addition, the National Climate Change Strategy adopted in 2007 by Mexico's Interministerial Commission on Climate Change (ICCC) reports the government's intention to expand this strategy even further and includes several initiatives that fall in this category.

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## COUNTRY PROFILE OF NEW ZEALAND

### Introduction and country definitions of eco-innovation

#### *Definitions related to eco-innovation used in the Country*

The Ministry of Economic Development defines innovation as ‘the dynamic process of creating and introducing new ideas and new ways of doing things. Innovations may be *incremental* (small, stepwise improvements), *major* (substantial improvements), or *radical* (new lines of business, paradigm shifts)’.

For the Business Operations Survey 2005 innovation module, Statistics New Zealand used a definition of innovation from the OECD Oslo Manual (2005) where an innovation is defined as the development or introduction of new or significantly improved:

- goods or services – this does not include the selling of new goods or services wholly produced and developed by other businesses
- operational processes – i.e. methods of producing or distributing goods or services
- organisational/managerial processes – i.e. significant changes in the business’s strategies, structures or routines
- marketing methods – this includes sales and marketing methods intended to increase the appeal of goods or services for specific market segments, or to gain entry to new markets.

Innovation is broadly defined. It includes the development or introduction of any new or significantly improved activity for the business. This includes products, processes and methods that the business was the first to develop and those that have been adopted from other organisations.

The term “innovation system” in New Zealand is taken to mean the pivotal technological, economic, social and institutional structures that encourage and support innovative development. This includes core Government policy departments and programme delivery agencies; government commercial entities such as State Owned Enterprises; universities and research bodies such as Crown Research Institutes; legislation and associated regulatory agencies; regional and local Government; and firms, supply chains, independent research providers, industry training organisations, financial institutions, markets and investors.

Almost all the above entities maintain websites that describe their operations and provide information on relevant programmes and activities.

The term mostly used in New Zealand policies and initiatives to describe eco-innovation related actions is sustainability.

### ***Institutions playing a major role in eco innovation***

#### *Policy departments and the subsidiary principle*

The Government policy departments with primary responsibilities with regard to innovation are the Ministry of Economic Development ([www.med.govt.nz](http://www.med.govt.nz)), Ministry of Research, Science and Technology ([www.morst.govt.nz](http://www.morst.govt.nz)) and Ministry of Agriculture and Forestry ([www.maf.govt.nz](http://www.maf.govt.nz)). The Ministry for Economic Development also encompasses energy policy and reports to the Minister of Energy on these issues.

The Ministry for the Environment is the Government policy agency with over-arching responsibility for the implementation of the Resource Management Act (RMA) and Hazardous Substances and New Organisms Act (HSNO, see below). The Department of Conservation is responsible for the protection of natural and historical heritage.

Starting with the Resource Management Act (1991), environmental management was founded upon the ‘subsidiary principle’, where the power of decision-making rests as close as possible to the affected communities.

Under this system of governance, central government can issue national policy statements on any aspect of resource management which is of national significance. They will provide direction for district and regional councils.

Regional councils are responsible for the mandatory regional policy statements. These statements will consider issues of significance to the region, outline the community's goals for the environment and the policies necessary to achieve these goals.

The Ministry of the Environment maintains a number of excellent web sites where business can easily access tools, links, grants, partnerships, initiatives etc.

<http://www.mfe.govt.nz/>; [www.sustainability.govt.nz](http://www.sustainability.govt.nz/); <http://www.climatechange.govt.nz>

The Ministry Sustainable Business Initiatives are available here: <http://www.mfe.govt.nz/issues/sustainable-industry/initiatives/>

The Ministry for Economic development website also provides information on sustainability, energy and economic policy.

[http://www.med.govt.nz/templates/ContentTopicSummary\\_\\_\\_\\_\\_27750.aspx](http://www.med.govt.nz/templates/ContentTopicSummary_____27750.aspx)

The Ministry of Agriculture and Forestry website contains information on sustainability resource use issues for agriculture <http://www.maf.govt.nz/mafnet/rural-nz/sustainable-resource-use/>.

#### *Relevant agencies*

Alongside the core policy departments are operational and/or regulatory agencies charged with delivering and implementing associated programmes and legislation. These are:

- The Foundation for Research Science and Technology (FRST, <http://www.frst.govt.nz/>). FRST is a Crown Entity that invests in research, science and technology on behalf of the NZ

Government. It is a key driver of innovation and has programmes and funding for eco innovation projects.

- New Zealand Trade and Enterprise (NZTE, <http://www.nzte.govt.nz/>) is the agency that delivers Government economic development programmes directed at growth and innovation in exports, regions, sectors and firms. Their website contains information on relevant programmes.
- The Energy Efficiency and Conservation Authority (EECA, <http://www.eeca.govt.nz/>) is the main body responsible for helping to deliver the Government's extensive energy efficiency agenda. Its function is to encourage, promote and support energy efficiency, energy conservation and the use of renewable energy sources and related innovative technologies.
- The Environmental Risk Management Authority (ERMA, <http://www.ermanz.govt.nz/>). ERMA implements the HSNO Act and has a key role in managing the risks of new organisms and hazardous substances and therefore has a key role in the speed of technological innovation in a range of areas.

### ***Policy documents related to eco-innovation***

Over-arching New Zealand policy and strategy documents include the following.

#### *Initial legislative background*

An important over-arching legislative influence on innovation is the Resource Management Act (1991)<sup>89</sup> (RMA). This defines sustainable management in ways that address social, economic, and cultural considerations, including meeting the needs of future generations, safeguarding the life-supporting capacity of natural resources and ecosystems, and avoiding, remedying, or mitigating the adverse environmental effects of human activities. The RMA devolves a significant body of decision making relating to innovation in the areas of environment, infrastructure and development to regionally based government.

Another important influence on innovation, environment and development is the Hazardous Substances and New Organisms Act 1996 (HSNO). This legislation sets the requirements for the introduction and use of defined substances over a set hazard threshold, and new organisms.

There is a strong sense of sustainability, resource management and conservation of natural resources through the RMA, HSNO and the Environment and Conservation agencies (Ministry for the Environment, Department of Conservation, Local Government). Although the RMA devolves many performance standards the Government can set overall national targets, objectives and other requirements through initiatives such as the Energy Strategy 2007 and the Framework for a New Zealand Emissions Trading Scheme 2007. These initiatives, along with the RMA and HSNO, act to facilitate and incentivise 'eco-innovation' and sustainable development.

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<sup>89</sup> Resource Management Act 1991 <http://www.mfe.govt.nz/rma/index.php> or [www.legislation.govt.nz](http://www.legislation.govt.nz)

*The Growth and Innovation Framework (GIF)*

Released in February 2002, the GIF (<http://www.gif.med.govt.nz>) set innovation as the pivotal feature of the next phase of New Zealand's economic development. A Growth and Innovation Advisory Board was established in May 2002 to provide an independent perspective on how the Government can advance its Growth and Innovation Programme. In 2006 the GIF was updated as the Economic Transformation Agenda which set five core themes (Growing Globally Competitive Firms, World Class Infrastructure, Innovative and Productive Workplaces, Auckland as an Internationally Competitive City and Environmental Sustainability).

*The Government's package of sustainability initiatives*

In February 2007, the Prime Minister outlined her vision for New Zealand to be the first country to be truly sustainable. She announced six new sustainability initiatives. These initiatives are part of a broader cross-government work programme to lead New Zealand towards greater sustainability in resource use and way of life.

The six initiatives include helping households towards sustainability, business partnerships for sustainability, eco-verification demonstrating the sustainability of goods and services, sustainable procurement, a carbon neutral public service, and zero waste. The Government has tasked core agencies to implement the sustainability package of six initiatives. The initiatives are being led by Ministry for the Environment or Ministry for Economic Development. Work on the six initiatives sits alongside much existing work to promote sustainability, including:

- The New Zealand Energy Strategy (see below);
- The New Zealand Waste Strategy (see below);
- The New Zealand Energy Efficiency and Conservation Strategy; published in October 2007, the Plan is targeted at maximising energy efficiency and renewable energy. This is the second five year strategy released under the Energy Efficiency and Conservation Act 2000 (the first was released in 2001)
- The New Zealand Transport Strategy. The Vision behind the strategy is that, by 2010 New Zealand will have an affordable, integrated, safe, responsive, and sustainable transport system. In 2008, the government will publish an update of the New Zealand Transport Strategy. This Update will provide direction for the transport sector until 2040 in the context of the government's sustainability agenda and other government strategies in the areas of energy and energy efficiency; translate that direction into high-level targets for the transport sector; provide clearer guidelines for decisions about funding allocations; contain an action plan.
- The Sustainable Land Management and Climate Change action plan. The Plan of Action covers adaptation to climate change, mitigation of climate change additional to the Emissions Trading Scheme (see below) and business opportunities arising from climate change. Research, technology transfer and communications is also covered. The Government will continue to develop key elements of this Plan of Action in partnership with industry sectors, local government and Māori.

## **Policies, Initiatives and instruments – a national inventory**

In addition to those indicated in section 1, this chapter outlines initiatives undertaken in New Zealand to foster environmental innovation.

### ***Research and Development***

A number of research and development and commercialisation initiatives have been identified. These include:

- Programmes run by the Foundation for Research, Science and Technology
- Sustainable Business Initiatives;
- The Pastoral Greenhouse Gas Research Consortium (PGgRc).

Other initiatives not reported here include individual EECA programmes (e.g. the Marine Energy Deployment Fund); FRST programmes such as the Low Carbon Energy Fund 2007; NZTE programmes such as the Australia New Zealand Biotechnology Partnership Fund, Regional Strategy Fund, Strategic Investment Fund.

A selection of local initiatives is highlighted.

#### *The Foundation for Research, Science and Technology*

The Foundation was established by the Research, Science and Technology Act 1990 to invest in science and technology research for the benefit of New Zealand. It is a Crown Agent governed by a Board appointed by the Minister of Research, Science and Technology. Its aim is to stimulate prosperity and improve the well-being of New Zealanders and the environment through investing in innovation and fostering the creation of new knowledge. It invests approximately NZ\$450 million of public money per annum through a number of funds and schemes to help support: 'public good' related science and technology, undertaken by Crown Research Institutes, universities, private researchers and industry led-consortia; private sector business research and development; and top-achieving students and researchers.

<http://www.frst.govt.nz>

#### *Sustainable Business Initiatives*

The Ministry of the Environment maintains an excellent web site where business can easily access tools, links, grants, partnerships, initiatives etc.

<http://www.mfe.govt.nz/>, <http://www.sustainability.govt.nz>, <http://climatechange.govt.nz>

The Ministry Sustainable Business Initiatives are available at <http://www.mfe.govt.nz/issues/sustainable-industry/initiatives/>

#### *The Pastoral Greenhouse Gas Research Consortium (PGgRc)*

Launched in 2002, this is a consortium of organisations from the agriculture industry (AgResearch Ltd, Dairy Insight, DEEResearch, the Fertiliser Manufacturers' Research Association,

Fonterra, Meat and Wool New Zealand and Wrightson Ltd) who, with FRST (the Foundation of Research, Science and Technology), match fund investment which aims to understand and provide mitigation solutions for greenhouse gases produced by grazing animals.  
<https://www.pggrc.co.nz/default2.asp>

#### *Selected local initiatives on green R&D*

A range of regional and local activities are also in place in New Zealand.

#### Target Sustainability

This is a programme developed by Christchurch Council to improve the efficiency of businesses. There are three categories - Waste, Water and Energy. The web site provides a calculator and auditing tools. It also provides a recycling directory.

<http://www.ccc.govt.nz/TargetSustainability/>

#### Cleaner Production

Extensive information on the council of Waitakere's Cleaner Production programme is available from their website. Good practice guides are available for a number of sectors including restaurants and cafes, retail, building, printing and sustainable living. The web site hosts best practice projects, a newsletter ('Wise Resource Use', distributed to around 4,500 local businesses to showcase cleaner production initiatives adopted by other local businesses); guidelines for business sustainability:

<http://www.waitakere.govt.nz/abtcit/ec/clnprod/resrcs.asp>; a service of auditing of resources' use (energy, water, materials) to reduce wastage, reduce their environmental impact, and increase profitability) is provided by the Council.

<http://www.waitakere.govt.nz/abtcit/ec/clnprod/services.asp>

#### Monitoring and minimising your company's environmental footprint

This programme set up by Auckland Council offers a wide range of tools such as: cleaner production checklists, toolkits, and Environmental Operations Plans.

<http://www.arc.govt.nz/arc/index.cfm?74628379-62E2-419B-AD53-921B5C4AFBCF#usefulsites>

#### Auckland Regional Council Programmes for Cleaner Production

REBRI stands for Resource Efficiency in the Building and Related Industries:

<http://www.arc.govt.nz/arc/index.cfm?F16D140D-DFE2-47D6-835F-B8F52ACCB91D>

#### *Verification of technologies*

The major initiative in this domain is the Enhanced Eco-verification initiative, which sets out to improve information about standards and certifications relating to reduced environmental impacts of products and firms, facilitate tools to help businesses meet those standards, and enhance systems to verify that the standards have been met.

<http://www.mfe.govt.nz/issues/sustainability/eco-verification.html>

### ***Performance Targets***

Initiatives identified in this area include:

- New Zealand Energy Strategy;
- New Zealand Energy Efficiency and Conservation Strategy (see above);
- Minimum Energy Performance Standards (MEPS);
- Greenlight;
- National Environmental Standards;
- The New Zealand Waste Strategy;
- New Zealand Packaging Accord;
- Carbon Neutral Government Agencies.

#### *New Zealand Energy Strategy*

Released in October 2007 the strategy sets out the Government's vision for a sustainable, low emissions energy system and includes an action plan for implementation. The Strategy sets a target of generating 90 percent of New Zealand's electricity from renewable energy sources by 2025. [http://www.med.govt.nz/templates/ContentTopicSummary\\_19431.aspx](http://www.med.govt.nz/templates/ContentTopicSummary_19431.aspx)

#### *Minimum Energy Performance Standards (MEPS)*

The Government introduced regulations in February 2002 which require selected products and appliances to meet minimum energy performance standards (MEPS) and/or energy labelling requirements: Energy Efficiency (Energy Using Products) Regulations 2002 (<http://www.eeca.govt.nz/eeca-library/products/standards/report/energy-efficiency-energy-using-products-regulations-04.pdf>). Standards are set in collaboration with the Australian Government; all standards are or soon will be joint standards with Australia (<http://www.standards.co.nz/default.htm>).

Thereafter, a set of regulations on energy efficiency have been drafted:

- Energy Efficiency (Energy Using Products) Amendment Regulations 2004 (<http://www.eeca.govt.nz/eeca-library/products/standards/report/energy-efficiency-energy-using-products-amendment-regulations-04.pdf>);
- Appliance and Equipment Energy Efficiency - Forward Programme 2004-05 covers:
  - proposed increases in energy efficiency stringency levels, on products covered by the Energy Efficiency (Energy Using Products) Regulations 2002 (the Regulations);
  - products currently being considered for introduction under mandatory MEPS or labelling; and
  - proposals for 17 additional products. Many of these proposals will involve further investigation (i.e. Standby Power - Dishwashers and Washing Machines, External Power Supplies (from 1 October 2008), Set Top Boxes (not before 1 October 2008), Home Entertainment Products (from 1 October 2008), Heating Ventilation & Air Conditioning (HVAC), Chillers (not before 1 October 2008), Gas Water Heaters (not before October 2008) <http://www.eeca.govt.nz/eeca-library/products/report/forward-programme-05.pdf>

*Greenlight*

New Zealand is developing a programme on the basis of the one developed in Australia for the promotion of efficient lighting in business. It will include Mandatory energy performance standards and energy labelling.

<http://www.energyrating.gov.au/library/pubs/200418-greenlight.pdf>

*National Environmental Standards*

The Government has developed National Environmental Standards. The Air quality standard is in force as regulation. National Environmental Standards in development regard: human drinking water source; water measuring devices; telecommunications facilities; electricity transmission. Moreover, the Ministry is currently scoping the potential for the development of standards to address on-site waste water systems and contaminated land.

<http://www.mfe.govt.nz/laws/standards/index.html>

*The New Zealand Waste Strategy*

This includes a target requiring all substandard wastewater treatment plants to be upgraded, closed or replaced by December 2020. The Ministry for the Environment partners the New Zealand Water and Wastes Association to develop initiatives which improve the country's environmental performance in the area of wastewater. A number of joint initiatives exist to manage wastewater, among which a list of code compliant contractors and guidelines.

<http://www.mfe.govt.nz/issues/waste/wastewater/index.html>

*New Zealand Packaging Accord*

The Packaging Council of New Zealand and the Ministry for the Environment have brought together brand owners, retailers, importers, manufacturers, recyclers and local government to negotiate a New Zealand Packaging Accord. The Accord is a voluntary industry and government initiative which sets targets aimed at making more sustainable use of packaging in order to reduce its life-cycle impacts. It is in particular aimed at reducing waste while improving the efficiency along the chain of manufacturing, use and recovery of packaging materials. Producers (brand owners and retailers/importers) will take responsibility for what happens to their packaging products throughout their lifecycle - from manufacture to use, to recycling and eventual disposal. Also involved in this lifecycle are manufacturers of packaging, councils and businesses that collect used packaging material for recycling, and consumers who buy and throw away packaging.

<http://www.mfe.govt.nz/issues/sustainable-industry/initiatives/packaging/index.html>

*Carbon Neutral Government Agencies*

The Ministry for the Environment, Ministry of Health, Ministry for Economic Development, Inland Revenue Department, Department of Conservation and The Treasury are all due to be carbon neutral by 2012. They will: measure all emissions associated with energy, transport and waste to landfill, starting with the 2006/07 financial year as a baseline measure; develop emission reduction plans by mid-December 2007; and offset unavoidable emissions through New Zealand based projects.

The Ministry for the Environment is leading the programme, which has a budget of \$10.4 million over three years.

<http://www.mfe.govt.nz/issues/sustainability/public-service-carbon-neutrality.html>

### ***Mobilisation of Financing***

Initiatives in this area include:

- The Energy Intensive Business (EIB) project;
- Bio-energy Gateway;

#### *The Energy Intensive Business (EIB) project*

This project, run by the Energy Efficiency and Conservation Authority (EECA), offers cash grants to businesses to help them adopt energy saving technologies. The project is targeted at companies that spend a high portion of their business costs on energy, allowing them to apply for up to 40 per cent of the capital cost of an energy efficiency project (to a maximum of \$100,000). The grants are designed to pay for projects that include energy efficient technologies such as: high efficiency motors; fans and boilers; variable speed drives; dehumidifier dryers; heat recovery; storage and retention; cogeneration; renewable waste product fuels; industrial refrigeration; fishing technologies; and soil moisture sensing. Examples of initiatives supported by the EIB project include:

- Implementation of a heat recovery system at Tegel Food's New Plymouth factory (a poultry plant). The system uses waste heat from the plant's industrial refrigeration system and main air compressor to preheat process water. This looks set to save the company more than \$110,000 a year in gas and electricity and cut the factory's CO<sub>2</sub> emissions by over 600 tonnes a year.
- Conversion of a boiler at Christchurch specialty meats producer Verkerks from burning diesel to burn tallow (a meat processing byproduct), which looks likely to cut the company's energy costs by \$150,000 a year and has also cut the factory's particulate matter emissions by 60%.

<http://www.eecabusiness.govt.nz/eib/>

#### *Bio-energy Gateway*

This is a programme to support the use of wood waste as a renewable energy source from businesses. EECA is coordinating the bioenergy initiative of the Government's Forest Industry Development Agenda (FIDA) to increase the uptake of renewable energy from the forestry sector. It provides tools, calculator and forums for the business

<http://www.bioenergy-gateway.org.nz/>

Capital grants are awarded for projects and for feasibility studies

<http://www.eeca.govt.nz/renewable-energy/bioenergy/fida.html>

*Envirolink*

The Envirolink scheme funds research organisations (Crown Research Institutes, universities and some not-for-profit research associations) to provide Regional Councils with advice and support for research on identified environmental topics and projects. The scheme aims to support Regional Councils in two areas of environmental management: adapting management tools to local needs, and translating environmental science knowledge into practical advice. Envirolink investment funding is \$1.6 million per annum.

<http://www.frst.govt.nz/research/Envirolink.cfm>

***Market-based Instruments***

The main initiative is the Emission Trading Scheme. Legislation implementing the ETS was introduced in December 2007 (<http://www.climatechange.govt.nz/nz-solutions/trading-scheme-reports.shtml>). The government has made an in-principle decision that the Emissions Trading Scheme will include all major sectors and all greenhouse gases specified in the Kyoto Protocol. It is expected that by 2013 all major sectors will be included. See <http://www.nzeur.govt.nz>. This initiative will stimulate research and investment in new areas of economic opportunity associated with sustainable lower energy technologies and climate change commitments.

Other initiatives include the Biofuels Sales Obligation. In October 2007 the Government announced that it will introduce a mandatory obligation on firms that sell petrol or diesel in New Zealand to also sell biofuels (<http://www.transport.govt.nz/biofuels-440-index/>). This will act as a primary incentive to innovate in the area of cost effective energy sustainability and climate change commitments.

***Procurement***

Initiatives identified in this area include:

- The Govt<sup>3</sup> programme
- Single procurement policy
- Waste management and recycling procurement

*The Govt<sup>3</sup> programme*

This programme aims to help government departments get their own house in order – aiming for a carbon neutral public service, focusing on recycling/waste minimisation, buildings, transport, office consumables and equipment.

*Single procurement policy*

The Government is currently developing a single procurement policy to ensure sustainably produced goods and services are purchased wherever possible. This programme will be closely aligned with the development of eco-labels, standards and verifications processes to assist procurement decisions and influence businesses.

<http://www.mfe.govt.nz/issues/sustainability/procurement.html>

[http://www.med.govt.nz/templates/StandardSummary\\_\\_\\_\\_\\_181.aspx](http://www.med.govt.nz/templates/StandardSummary_____181.aspx)

#### *Waste management and recycling procurement*

This document provides practical advice and tools to use when procuring waste management and recycling contracts. The emphasis is on local government contracts because of the major role councils play in waste management in New Zealand, but businesses and industry may find some of the principles useful.

<http://www.mfe.govt.nz/publications/waste/best-practice-recycling-waste-mgmt-jul07/index.html>

#### *Awareness raising and training*

There are numerous initiatives at the central, regional and local levels to promote sustainable management and practices by the public and businesses. Consultation, public meetings and awards are frequent. Below can be found a small selection of different types of engagement:

- Energy Star and Energy Rating labels
- Lighting Efficiency Stakeholder Group
- Water awareness campaign
- EECA Energywise Awards 2007
- Talk Environment Road show
- Green Ribbon Awards
- World Environment Day 2008 to be hosted in New Zealand. (Identified Theme: Kick the Habit – Carbon Neutrality)
- BusinessCare

#### *Energy Star and Energy Rating Label*

New Zealand adopted in 2005 the Energy Star label for household and office appliances. EECA is currently working on Energy Star specifications for fridges, freezers and compact fluorescent light bulbs.

<http://www.energystar.govt.nz/>

Fridges, freezers, and single-phase domestic air conditioners must also display an Energy Rating Label (see <http://www.eeca.govt.nz/labelling-and-standards/energy-rating-labels.html>).

A database of energy efficient appliances and equipment is covered by Minimum Energy Performance Standards and by the Energy Rating Label, and hosted by the Australian Government (New Zealand and Australia set a joint programme) (see <http://www.energyrating.gov.au/>).

*Lighting Efficiency Stakeholder Group*

This is an example of the participation of business in decision-making. EECA and the Electricity Commission are keen to encourage and facilitate input into the development of an efficient lighting strategy from across the lighting industry and wider stakeholders. To achieve this, a Lighting Efficiency Stakeholder Group was formed.

<http://www.electricitycommission.govt.nz/advisorygroups/pjtteam/lesg>

*EECA Energywise Awards 2007*

This initiative is New Zealand's biggest celebration of achievement and innovation in the energy efficiency and renewable energy industry, organised by EECA.

<http://www.eeca.govt.nz/news/awards/index.html>

*BusinessCare*

The BusinessCare National Trust has been set up as a not-for-profit trust funded by MFE Sustainable Management Fund plus significant in-kind support from a number of local authorities around the country. BusinessCare's focus is on promoting, supporting and encouraging the implementation of sustainable management and cleaner production practices by local SME businesses nationwide. It seeks to work at both the national level and the local level. By providing training and support, BusinessCare aims to increase the number of people who have cleaner production skills throughout the country, giving business and industry greater access to experts to help them towards a sustainable future.

The organisation has a number of programmes to disseminate information on sustainable solutions to the business community.

The Business Sustainability assessment tool is an instrument developed by the Christchurch City Council and a group of other local bodies under the BusinessCare umbrella organisation. The tool draws on work undertaken by the EPHC (a council of Australian State Governments in which New Zealand is an invited participant) which developed a framework to assist local government agencies in both New Zealand and Australia implement strategies for improving the capacity of business to implement sustainable practices in terms of use of energy, water, raw materials, packaging, chemicals

[http://www.businesscare.org.nz/gettingstarted/satool/Sustainability\\_Assessment\\_Tool.xls](http://www.businesscare.org.nz/gettingstarted/satool/Sustainability_Assessment_Tool.xls)

The Cleaner Production Tool Kit includes information sheets on all aspects of sustainable business practice and cleaner production, including an environmental purchasing guide, a Green Guide for Vehicle Fleet Management and a sample Solid Waste Management Plan. Businesses can sign up to BusinessCare to receive these information sheets.

*Simply Sustainable Programme*

This is a programme developed by the Environment Ministry. Here businesses can find a database of services and tools regarding: cleaner production, energy efficiency and conservation, waste minimisation, product life cycle and environmental management systems. It includes case studies, guidelines, grants, lists of contacts, initiatives. It can be thought of as a 'platform' for sustainable businesses:

<http://www.mfe.govt.nz/issues/sustainable-industry/tools-services/topics.php?id=4>

### *Acting Globally*

A number of the initiatives presented above have an international reach. Typically, Energy Performance Standards are jointly set with Australia. The most notable area of international activity for New Zealand is a considerable amount of cooperation with Australia. The two countries have undertaken a number of joint initiatives, including the Australia-New Zealand Climate Change Partnership. Other bi- and multilateral initiatives are United States-New Zealand Climate Change Partnership; Trade and environment.

#### *Australia-New Zealand Climate Change Partnership*

In July 2003, the New Zealand and Australian governments announced a joint Climate Change Partnership, built around five themes:

- Engaging with business and local government on technology development, policy design and implementation;
- Building on existing cooperation on energy efficiency;
- Measuring and reducing emissions from the agricultural sector;
- Further enhancing climate change science and monitoring;
- Working together with our Pacific island neighbours to address the regional challenges posed by climate change.

<http://www.greenhouse.gov.au/international/partnerships/newzealand.html>

#### *United States-New Zealand Climate Change Partnership*

This was launched on 25 October 2002 with a list of projects announced on 25 July 2003: Climate change science; Technology development; Greenhouse gas accounting in forestry and agriculture; Engagement with business; Cooperation with developing countries; Climate change research in Antarctica; Public education initiatives.

<http://www.mfat.govt.nz/Foreign-Relations/1-Global-Issues/Environment/Climate-Change/climchangeinteng.php>

### *Trade and Environment*

New Zealand promotes sustainable development through its international trade policy. Environment provisions are negotiated in New Zealand's bilateral and regional trade agreements. The Ministry for the Environment promotes New Zealand's environmental and sustainability expertise to encourage new government, research and business partnerships with its trade agreement partners.

New Zealand also promotes sustainable development in WTO negotiations by actively working to liberalise market access for environmental goods and services.

## Country Synthesis

Sustainability, and in particular environmental sustainability, is one of the five core themes of New Zealand's Economic Transformation Agenda. This has been coined at the highest political level and has inspired a comprehensive set of initiatives: in February 2007, the Prime Minister outlined her vision for New Zealand to be the first country to be truly sustainable; she announced six new sustainability initiatives which are part of a broader cross-government work programme to lead New Zealand towards greater sustainability in resource use and way of life. The implementation of the initiatives is led by the Ministry for the Environment or the Ministry for Economic Development.

New Zealand's approach to sustainable development is participatory, decentralised and inclusive. And innovation is considered as the pivotal feature of the next phase of New Zealand's economic development.

The development of metrics plays a key role in the strategy. The Government is working to set New Zealand as a global leader in research and development in product life-cycle analysis and application of eco-verification support structures. In particular, it is working with stakeholders to position New Zealand as a leader in carbon-footprint measurement and management – and in areas that will make the greatest contribution to sustainability and economic transformation. The development of mandatory standards for equipment and appliances goes in the same direction.

In this framework, the government has undertaken a number of initiatives, which are characterised by

- a genuine partnership with the business community;
- a priority on information sharing and dissemination, in particular on resource efficiency;
- an international (if not global) reach.

### *A genuine partnership with the business community*

This is illustrated by the business partnerships for sustainability and the Energy Intensive Business project. This is done to preserve and enhance the physical environment and foster greater national identity, and to ensure ongoing competitiveness in a world where consumers are increasingly demanding innovative, eco-friendly and low carbon products and services.

In particular the first of a set of strategic priorities of the government sponsored programme aimed to promote and develop the adoption of sustainable business practices in New Zealand (the 'Business partnership for sustainable development') is 'marketing sustainable businesses and helping sustainable businesses access new markets here and overseas'. This involves working with business networks, such as the Chambers of Commerce, the New Zealand Business Council for Sustainable Development and the Sustainable Business Network, to enhance business sustainability programmes.<sup>90</sup>

The ambitious Emission Trading Scheme illustrates how sectoral emissions' reductions coverage is based on the principle of 'equity' - by way of equitable sharing of responsibility across sectors and

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<sup>90</sup> For more information on the 'Business partnership for sustainable development' follow this link to the Ministry of the Environment website: <http://www.mfe.govt.nz/issues/sustainability/business-partnerships.html>

stakeholders participating in the Emission Trading Scheme. This differs from the approach taken in the EU, where not all sectors are involved.

*A focus on resource efficiency*

This is illustrated by initiatives in areas including research and development (e.g. Sustainability assessment tool and Christchurch Council's Target Sustainability programme), performance targets (e.g. Minimum Energy Performance Standards for appliances and equipment and the New Zealand Packaging Accord), and mobilisation of financing (e.g. The Energy Intensive Business project).

*An international (if not global) reach*

New Zealand can be seen to set a good example in terms of working with a close neighbour, namely Australia, on various sustainability and eco-innovation initiatives. Activities include initiatives in the areas of research and development (the Business Sustainability Framework and Sustainability assessment tool), the development of equipment and appliances performance standards which is carried out jointly by the two countries (e.g. Energy Rating Label, Minimum Energy Performance Standards), and the bilateral Australia-New Zealand Climate Change Partnership.

## Appendices

### Summary table

Actions	Initiatives
Research and Development and commercialisation	<ul style="list-style-type: none"> <li>▪ The Foundation for Research, Science and Technology programmes</li> <li>▪ Sustainability assessment tool</li> <li>▪ Simply Sustainable Programme</li> <li>▪ Ministry of the Environment website</li> <li>▪ Ministry for Economic Development website</li> <li>▪ Ministry of Research Science and Technology website</li> <li>▪ Ministry of Agriculture and Forestry website</li> <li>▪ BusinessCare Cleaner Production Tool Kit</li> <li>▪ The Pastoral Greenhouse Gas Research Consortium (PGgRc)</li> <li>▪ Target Sustainability, Christchurch Council</li> <li>▪ Cleaner Production, Waitakere</li> <li>▪ Monitoring and minimising your company's environmental footprint, Auckland Council</li> <li>▪ Auckland Regional Council Programmes for Cleaner Production</li> </ul>
Verification of Technology	<ul style="list-style-type: none"> <li>▪ Database of energy efficient appliances and equipment</li> <li>▪ Energy efficiency regulation updates</li> <li>▪ Labelling Compliance Survey (2004)</li> <li>▪ Recycling directory</li> <li>▪ Energy services directory</li> <li>▪ The Enhanced Eco-verification initiative</li> </ul>
Performance Targets	<ul style="list-style-type: none"> <li>▪ New Zealand Energy Strategy</li> <li>▪ New Zealand Energy Efficiency and Conservation Strategy</li> <li>▪ Minimum Energy Performance Standards (MEPS)</li> <li>▪ Energy Rating Label</li> <li>▪ Energy Star</li> <li>▪ NZ Green Star</li> <li>▪ Greenlight</li> <li>▪ Implementation of a Mandatory Vehicle Fuel Economy Labelling Scheme</li> <li>▪ National Environmental Standards</li> <li>▪ The New Zealand Waste Strategy</li> <li>▪ New Zealand Packaging Accord</li> <li>▪ Carbon Neutral Government Agencies</li> </ul>
Mobilisation of Financing	<ul style="list-style-type: none"> <li>▪ Grants for Energy Efficient Technologies adopted in energy intensive industries</li> <li>▪ EECA good practice industry guidelines</li> <li>▪ Emprove</li> <li>▪ Bio-energy Gateway</li> <li>▪ The Energy Intensive Business (EIB) project</li> <li>▪ New Zealand Trade and Enterprise programmes</li> <li>▪</li> </ul>
Market-based	<ul style="list-style-type: none"> <li>▪ Emission Trading Scheme</li> </ul>

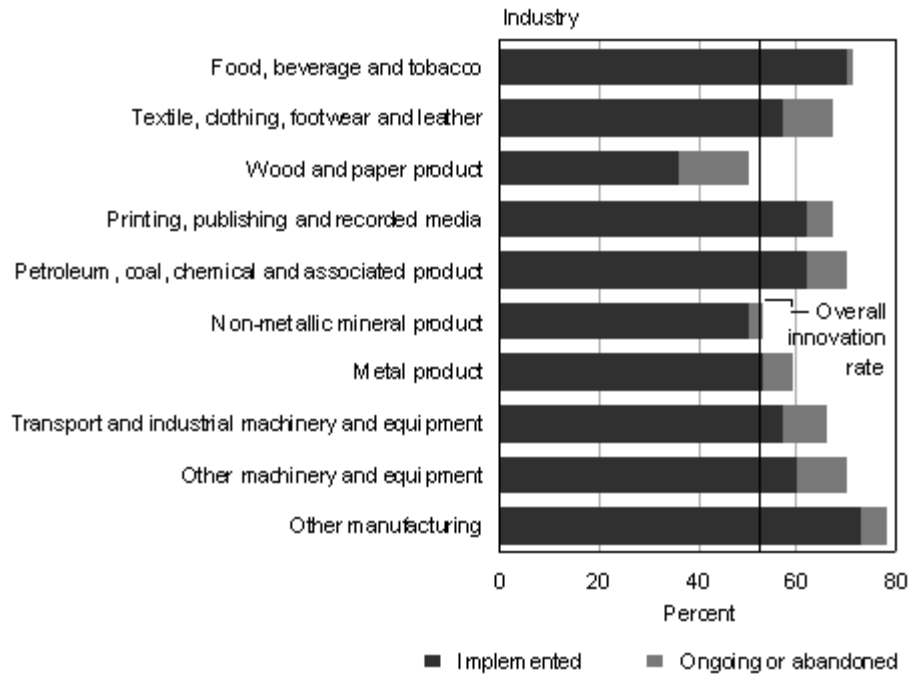
Actions	Initiatives
Instruments and State Aid	
Procurement	<ul style="list-style-type: none"> <li>▪ The Govt<sup>3</sup> programme</li> <li>▪ Single procurement policy</li> <li>▪ Waste management and recycling procurement</li> <li>▪ Ecolabels and eco-verification</li> </ul>
Awareness Rising and Training	<ul style="list-style-type: none"> <li>▪ Talk Environment Road show</li> <li>▪ Lighting Efficiency Stakeholder Group</li> <li>▪ Water awareness campaign</li> <li>▪ EECA Energywise Awards 2007</li> <li>▪ Green Ribbon Awards</li> <li>▪ World Environment Day 2008 to be hosted in New Zealand</li> </ul>
Acting Globally	<ul style="list-style-type: none"> <li>▪ Australia-New Zealand Climate Change Partnership</li> <li>▪ Sustainability assessment tool</li> <li>▪ Energy Rating Label</li> <li>▪ Minimum Energy Performance Standards (MEPS)</li> <li>▪ Greenlight – based on a similar initiative undertaken in Australia</li> <li>▪ Trade and Environment</li> </ul>

### *The environmental benefits of innovation in New Zealand*

The Business Operations Survey 2005, carried out by Statistics New Zealand, is the most recent and most extensive collection of statistics on innovation in New Zealand. The finance and insurance industry reported the highest rate of innovation, at 68 percent, followed by manufacturing, at 65 percent. Examining manufacturing in more detail, the survey shows that innovation rates in the manufacturing industry ranged from 49 percent to 78 percent. Only the wood and paper product industry division had an innovation rate lower than the overall New Zealand innovation rate of 52 percent (see figure 5 below).

**Figure 5. Innovation rate - Manufacturing**

Last two financial years, at August 2005

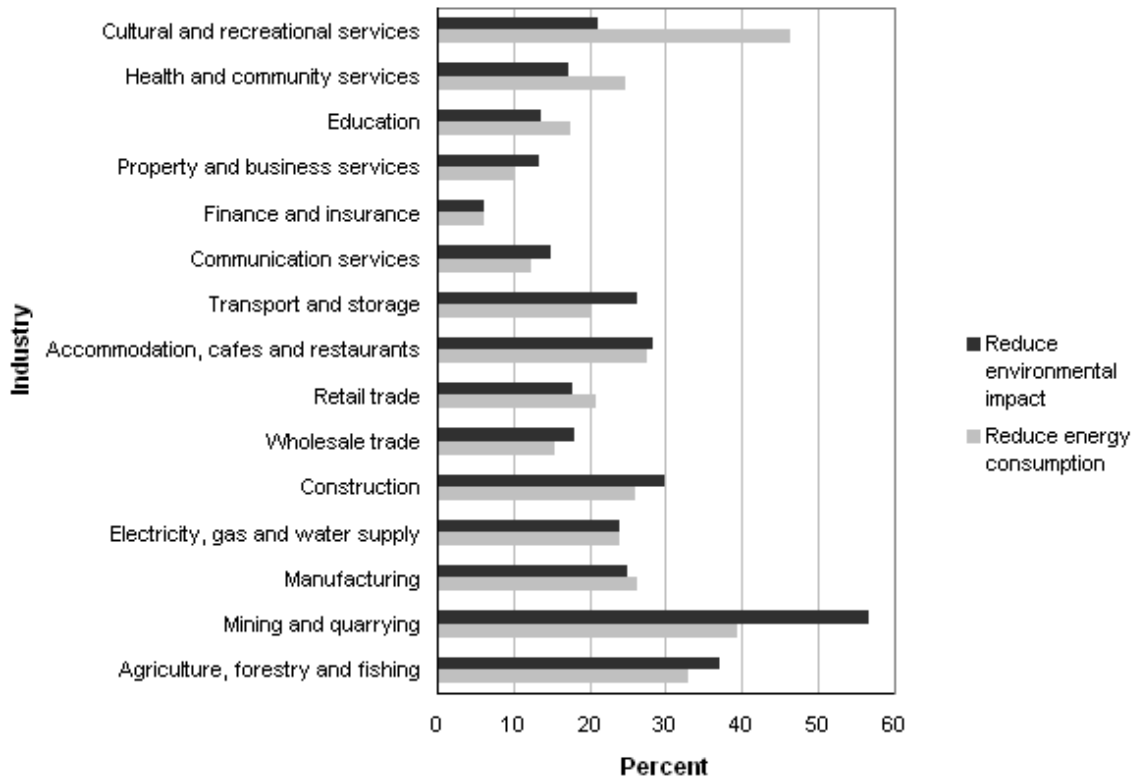


Source : Statistics New Zealand (2007) 'Innovation in New Zealand 2005', Wellington, New Zealand; available at: <http://www.stats.govt.nz/NR/rdonlyres/4D070B56-8EFB-4DFD-A351-3C145AC7B51C/0/5511SNZinnovationreportffweb.pdf>

The survey indicated that the most common reasons for innovating were to increase revenue (92 percent of all innovating firms) and improve productivity (81 percent). These were followed by reducing costs, increasing market share, increasing responsiveness of customers and establishing/exploiting new market opportunities. Just over one in five businesses reported reduced energy consumption or reduced environmental impact as reasons for innovating (both 22 percent) although this varied across industry groups, as figure 6 shows.

**Figure 6. Innovation to reduce energy consumption or environmental impact**

Last two financial years at August 2005



Source : Statistics New Zealand (2007) 'Innovation in New Zealand 2005', Wellington, New Zealand; available at: <http://www.stats.govt.nz/NR/rdonlyres/4D070B56-8EFB-4DFD-A351-3C145AC7B51C/0/5511SNZinnovationreportffweb.pdf>

## COUNTRY PROFILE OF TURKEY

### Introduction and country definitions of eco-innovation

#### *Definitions related to eco-innovation used in the country*

No definition of eco-innovation has been found.

#### *Institutions playing a major role on eco innovation*

##### *Supreme Council for Science and Technology (BTYK)*

The Supreme Council of Science and Technology was set up in 2003 and became fully operational in 2004. It was established to determine, direct and co-ordinate research and development policies in the field of science and technology towards the targets of economic development, social progress and national security. Among its tasks, the Council is responsible for assisting the Government in identifying long-term science and technology policies, determining R&D targets related to science and technology, identifying priority R&D areas and preparing related plans and programmes<sup>91</sup>.

##### *Scientific and Technological Research Council of Turkey (TUBITAK)*

TUBITAK was established in 1963 to organize, coordinate and encourage basic and applied research, especially in natural sciences. The Council funds research carried out by public research organisations and the private sector, and conducts research through its own research institutes. Furthermore, TUBITAK develops national science and technology policies and proposes them to the Supreme Council of Science and Technology for approval<sup>92</sup>. TUBITAK is the governmental institution managing the highest share of resources to finance research and innovation projects, including initiatives related to environment.

<http://www.tubitak.gov.tr/home.do;jsessionid=21362B531560A7E2EA55DE9C921CB2A3?ot=10&lang=en>

##### *Ministry of Energy and Natural Resources (MENR) (<http://www.enerji.gov.tr/>)*

The MENR is responsible for the formulation of national energy policies and the supervision of their implementation<sup>93</sup>.

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91 <http://cordis.europa.eu/erawatch/index.cfm?fuseaction=org.document&uuid=7D87CB5D-C15F-4146-A9D50E13997288C4>

92 <http://cordis.europa.eu/erawatch/index.cfm?fuseaction=org.document&uuid=7D87CB2E-9020-CDD4-359E187364837434>

93 <http://www.turkishweekly.net/comments.php?id=2513>

*Electrical Power Resources Survey and Development Administration (EIE)*

(<http://www.eie.gov.tr/english/index-e.html>)

EIE was founded in 1935 and is bound to the Ministry of Energy and Natural Resources. Among its tasks, EIE is in charge of researching new and renewable energy sources, undertaking surveys and studies on energy efficiency and raising awareness on energy conservation. EIE is also responsible for the implementation and coordination of the energy efficiency programmes, and is the National Energy Conservation Centre (NECC).

***Policy documents related to eco-innovation***

This section provides information about a selection of relevant documents.

*Vision 2023*

The National Research and Technology Foresight Programme (Vision 2023 Programme) was elaborated in 2002 under the coordination of TÜBİTAK. The Programme covers the period 2003-2023 and aims to: build long-term science and technology objectives; determine strategic technologies and priority areas for R&D; formulate science and technology policies for the next 20 years; and create public awareness of the importance of science and technology.

Energy and natural resources are some of the areas included in the Programme. The following priority topics for energy are mentioned: clean coal technologies; fuel cells for transport, stationary and portable applications; wind energy technologies; hydrogen combustion technologies; electricity production from solar energy; energy storage technologies; hydropower plants (mini and micro); nuclear energy; control technologies for power systems; energy conservation technologies in industry; reduction of energy consumption; and using renewable energies in buildings<sup>94</sup>.

[http://forlearn.jrc.es/guide/6\\_examples/turkey2023.htm](http://forlearn.jrc.es/guide/6_examples/turkey2023.htm) and  
<http://www.tubitak.gov.tr/home.do?ot=5&rt=3&sid=0&cid=3332>

*State Planning Organization: Ninth Five Year Development Plan (2007-2013)*

The plan analyses the state of play and the future objectives for Turkey in the area of competitiveness, employment, human development, development and effectiveness in public services. Among its key development objectives the plan includes, under the ‘increasing competitiveness’ axis: improving the energy and transportation infrastructures; protecting the environment and improving the urban infrastructure; improving R&D and innovation (including on hydrogen and fuel battery technologies); and improving efficiency of the agriculture structure

<http://ekutup.dpt.gov.tr/plan/ix/9developmentplan.pdf>

**Policies, Initiatives and instruments – a national inventory**

This chapter summarises the main initiatives undertaken in Turkey to foster environmental innovation, according to the information available in English in governmental and other official web sites. Currencies are in Turkish Lira, in US Dollar or in EU Euro.

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94 IEA, 2005

### ***Research and Development***

Most R&D initiatives on science and technology are funded and/or co-ordinated by TUBITAK (see <http://www.tubitak.gov.tr/home.do?ot=1&sid=991&pid=547>). Environmental technologies and initiatives can hence be funded through this channel, although funds are often not explicitly targeted to eco-innovation in particular.

Funds and initiatives that are most directly related to environmental technology R&D include:

- Coal Bed Methane Mitigation Research;
- Working groups on energy technologies;
- Support Programme for Scientific and Technological Research Projects;
- Pilot projects on alternative transport fuels; or
- Initiatives taken by the Ministry of Environment and Forestry.

#### *Coal Bed Methane Mitigation Research*

The General Directorate of the Turkish Hard Coal Enterprises (TKK) of the Turkish Government tendered a project of Research and Processing of Coal Bed Methane to identify best technologies in mitigating methane emissions during coal extraction and subsequent energy production<sup>95</sup>.

#### *Working groups on energy technologies*

Under the co-ordination of TUBITAK, working groups have been established to define technological options linked to energy efficiency and renewable energy. One of the major objectives of all the working groups is to assess available energy solutions and determine possible deployment strategies for new and renewable energy sources. As a result of these studies, a strategy will be prepared and submitted to the Prime Minister's High Council of Science and Technology for approval<sup>96</sup>.

#### *Support Programme for Scientific and Technological Research Projects*

This programme started in 1994 and is managed by TUBITAK. It is built to support research generating new information, doing scientific interpretation or solving technological problems, and projects having advanced technology applications. Its aim is to increase the national competitive capacity in international market within the framework of prioritized areas. Co-operation between the research community and the private sector is encouraged. 'Environment' is among the 12 research themes. The overall budget (for all themes) was €121 million for the period 2004 to 2006<sup>97</sup>. This also includes a variety of instruments to support R&D, with an emphasis on partnerships, international networks and incentives for technology suppliers.

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95 <http://www.iea.org/textbase/pm/?mode=cc&id=2455&action=detail>

96 <http://www.iea.org/textbase/pm/?mode=cc&id=729&action=detail>

97 <http://cordis.europa.eu/erawatch/index.cfm?fuseaction=prog.document&UUID=7D87B748-D847-0DDE-1ED2DE38E3C5ED96&hwd=>

*Pilot projects on alternative transport fuels*

Two demonstration projects are under way by the Istanbul Technical University (ITU) and Marmara University on the use of compressed natural gas (CNG) in public buses. The ITU project demonstrates the use of hybrid vehicles and the Marmara University project the conversion of engines for the use of natural gas<sup>98</sup>.

*Research under the Ministry of Environment and Forestry*

The Ministry has a Research and Development Department. This Department supervises the activity of laboratories. For instance, eleven Forestry Research Institutes established in the various regions of Turkey, carry out research and development studies both on regional and national level. Research projects cover all kinds of forestry and address environmental subjects according to needs and demands of the Ministry. Some of the most important ones include:

- Within the context of climate change, studies on tree/shrub species that are resistant to drought/freeze and salinity,
- The employability of treatment sludge at forestation activities,
- Forestation which are suitable for new conditions occurring near thermal power plants,
- Studies on fast growing species, for the purpose of supplying the demand of wood to decrease pressures on natural forests.

***Performance Targets***

Performance targets initiatives include:

- Energy Efficiency Law - No. 5627
- Labelling of Household Electrical Appliances
- Energy Efficiency in Public Buildings and Street Lighting
- Regulation on Heat Insulation in Buildings
- Labelling of Passenger Car Fuel Economy and CO2 Emissions
- Industrial Air Pollution Control Regulation
- Gasoline and Diesel Oil quality Regulation

*Energy Efficiency Law - No. 5627*

The Energy Efficiency Law, adopted in 2007, set forth measures for energy efficiency in energy generation, transmission, distribution and consumption phases at industrial establishments, buildings, power generation plants, transmission and distribution networks and transport. The law also aims to

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98 IEA, 2005

raise energy awareness in the general public, and to promote and increase the use of renewable energy sources.

([http://www.eie.gov.tr/english/announcements/EV\\_kanunu/EnVer\\_kanunu\\_tercume\\_revize2707.doc](http://www.eie.gov.tr/english/announcements/EV_kanunu/EnVer_kanunu_tercume_revize2707.doc))

#### *Labelling of Household Electrical Appliances*

Since February 2003, the Ministry of Industry and Trade requires the energy labelling of refrigerators, washing machines, dryers, dishwashers, electric ovens and lamps<sup>99</sup>.

[www.sanayi.gov.tr](http://www.sanayi.gov.tr)

#### *Energy Efficiency in Public Buildings and Street Lighting*

In 2000, the Turkish government developed plans that impose savings in power use in government buildings and cut-down on street lighting<sup>100</sup>.

#### *Regulation on Heat Insulation in Buildings*

Turkey adopted mandatory standards for heat insulation in new buildings in 1985. In 2000 the Regulation on Heat Insulation in Buildings set more stringent limits for annual heating energy requirements of buildings – differentiated according to climatic zones. While, according to the previous standards, buildings heating required about 200-250 kWh/m<sup>2</sup>, the new standards<sup>101</sup> were expected to bring down heating energy requirements to 100-150 kWh/m<sup>2</sup>. This regulation also obliges new buildings to possess an energy certificate that shows their energy consumption per square metre and cubic metre. At the end of 2005, the Turkish Parliament approved amendment to the Regulation to align it with EU Directive 2002/91/EC on the minimum energy efficiency of buildings<sup>102</sup>.

#### *Labelling of Passenger Car Fuel Economy and CO2 Emissions*

In December 2003 the Turkish government approved regulations for passenger cars on the basis of EU Directive 1999/94/EC on the mandatory labelling of vehicle fuel economy and CO2 emissions. From January 2008 on, the Turkish standards require passenger vehicles to display labels classifying cars by their comparative fuel efficiency and carbon dioxide emissions per kilometre. To further help consumers choose climate-friendly vehicles, a free consumer guide to fuel economy and CO2 emissions<sup>103</sup> is available.

#### *Industrial Air Pollution Control Regulation*

Standards exist for the emissions of NO<sub>x</sub>, SO<sub>2</sub>, CO and particulate matter (PM) from combustion plants. PM and CO standards have been lowered compared to 1986 levels. According to Air Quality Protection Regulation of 1986, PM limit concentrations are 150 mg/m<sup>3</sup> for new facilities and 250

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99 <http://www.iea.org/textbase/pm/?mode=cc&id=977&action=detail>

100 <http://www.iea.org/textbase/pm/?mode=cc&id=515&action=detail>

101 <http://www.iea.org/textbase/pm/?mode=cc&action=detail&id=593>

102 <http://www.iea.org/textbase/pm/?mode=cc&id=2458&action=detail>

103 <http://www.iea.org/textbase/pm/?mode=weo&id=2454&action=detail>

mg/m<sup>3</sup> for old facilities. In 2006 regulation, the limit value for PM is 100 mg/m<sup>3</sup> for both old and new facilities (for combustion plants, rated thermal input  $\geq$  50 MW). In order to comply with the regulation, lignite-fired power plants are being equipped with flue gas desulphurisation (FGD) technology. Electrostatic precipitators (ESP) are also being installed to reduce PM emissions.

The regulation also sets penalties for non compliance with emission standards and gives the Ministry of Environment and Forestry responsibility for plant authorisation and enforcement<sup>104</sup>.

#### *Gasoline and Diesel Oil Quality Regulation*

The regulation, passed in June 2004, aims at harmonising the Turkish gasoline and diesel oil standards with EU standards as set in Directive 2003/17/EC. A transitional period is allowed between 2007 and 2009 – shorter than the one allowed by the EU Directive, which started in 2005<sup>105</sup>.

#### ***Mobilisation of Financing***

This section refers to financial instruments that do not promote specific phases of technology development, but finance environmental innovation in general – e.g. funds which finance technology from cradle to grave. In some cases environmental innovation is not the main objective of the initiative, but is part of wider projects. Such financing initiatives include:

- Energy-Environment in Turkey;
- World Bank Renewable Energy Project.

#### *Energy-Environment in Turkey*

Within the framework of the Project ‘Energy-Environment in Turkey’, studies analysing alternative scenarios for the reduction of GHG emissions originated from activities taken in co-ordination with the World Bank in 2000. The project involved the Ministry of Energy and Natural Resources, the Electricity Generation Corporation and the Turkish Electricity Transmission Corporation. First, the ‘base case’ scenario for current projections for energy demand and supply has been studied and CO<sub>2</sub> emissions were estimated. Others scenarios involving various alternatives, such as increasing energy efficiency, improving fuel quality, application of advanced technologies, transmission and distribution losses, etc., are being analysed<sup>106</sup>.

#### *World Bank Renewable Energy Project*

In 2004, the World Bank approved a US \$202 million (about €163<sup>107</sup>) Renewable Energy Loan for Turkey, closing in 2010. A term lending facility has been established and is operated by two Turkish financial intermediaries - the private Turkish Industrial Development Bank (TSKB) and the public Turkish Development Bank (TKB) - which make loans to qualified private sponsors of renewable energy generation projects. In order to support the implementation of the Project, Ministry of Energy and Natural Resources (MENR), General Directorate of State Hydraulic Works (DSI) and General Directorate of Electric Power Resources (EIE) are also meant to undertake various

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104 IEA, 2005

105 IEA, 2005

106 <http://www.iea.org/textbase/pm/?mode=cc&id=798&action=detail>

107 Average exchange rate in 2004: 1US\$ = 0.805 EUR

institutional development activities. The main objective of the project is to increase privately owned and operated power generation from renewable sources such as hydro and wind. See:

<http://web.worldbank.org/external/projects/main?pagePK=104231&piPK=73230&theSitePK=40941&menuPK=228424&Projectid=P072480>

### ***Market-based Instruments and State Aid***

Market based instruments supporting eco-innovation in Turkey include:

- Electricity Market Licensing Regulation;
- Law on Utilization of Renewable Energy Resources for the Purpose of Generating Electrical Energy.

#### *Electricity Market Licensing Regulation*

The Electricity Market Licensing Regulation of the Electricity Market Law (No. 4628) promotes the use of renewable energy by requiring the legal entities applying for licences for construction of renewable energy facilities to pay only 1% of the total licence fee. In addition, renewable-based generation facilities are exempt from paying the annual licence fees for the first eight years from completion. The Turkish Electricity Transmission Company (TEIAS) and/or distribution companies are also required to give priority status to the connection to facilities based on renewables<sup>108</sup>.

#### *Law on Utilization of Renewable Energy Resources for the Purpose of Generating Electrical Energy*

Enacted in 2005, this law (No. 5346) aims to expand renewable energy resources (RES) for generating electricity, reduce greenhouse gas emissions, protect the environment and develop the manufacturing sector for renewable-energy related products. RES certified electrical energy can be purchased by legal entities holding retail sale license on the basis of bilateral agreements<sup>109</sup>. The law provides transitional arrangements (until 2011) for more competitive prices for electricity generated from plants that have a renewable energy resource certificate, and other incentives for investments in renewables (determined by the Council of Ministers). Furthermore the law gives the Council of Ministers the authority to increase the price applicable to renewable energy resources by a maximum 20% at the beginning of each year. The renewable energy law is a first step towards implementation of the *acquis* on renewables. However, the law does not set a target for electricity generated from renewable sources by 2010<sup>110</sup>. See:

[http://www.eie.gov.tr/english/announcements/YEK\\_kanunu/LawonRenewableEnergyReources.pdf](http://www.eie.gov.tr/english/announcements/YEK_kanunu/LawonRenewableEnergyReources.pdf)

In addition, the Energy Efficiency Law, passed in 2007, establishes renewable electricity purchase obligations. Renewable electricity purchase price ranges between 0.05 and 0.055 €/kWh<sup>111</sup>.

108 <http://www.iea.org/textbase/pm/?mode=cc&id=1650&action=detail>

109 <http://www.iea.org/textbase/pm/?mode=re&id=2475&action=detail>

110 European Commission (2005b)

111 <http://www.iea.org/textbase/pm/?mode=re&id=2457&action=detail>

### ***Procurement***

No policy on green procurement has been implemented yet. According to the European Commission Screening Report on Turkey, the integration of environment considerations in procurements is foreseen, in light the EU Acquis requirements<sup>112</sup>.

### ***Awareness raising and training***

Awareness raising and training initiatives include:

- Industrial energy manager courses;
- EIE/NECC awareness raising initiatives.

#### *Industrial energy manager courses*

Industrial energy manager courses began in 1997, with the support of the Japan International Cooperation Agency (JICA). Among other things, this project involved technical assistance on industrial energy efficiency, equipment donations, the establishment of an Energy Efficiency Training Centre, building a model plant and improving the energy manager courses. The US\$ 2.1 million model plant was opened in October 2001. A course on energy efficiency management has been organized by EIE and JICA in the context of the “Third Country Training Program” and took place in November 2007.

See: <http://www.eie.gov.tr/english/announcements/GI-20070917.doc>

#### *EIE/NECC awareness raising initiatives*

The EIE/NECC has a number of activities for raising awareness on energy efficiency in industry. These include operating a training bus, providing free publications, preparing technical manuals for energy managers, organisation of national and international conferences, seminars and workshops, and granting energy conservation awards to companies<sup>113</sup>. A public awareness project on energy efficiency in buildings was programmed in 2005<sup>114</sup> and had a total budget of € 1.07 million<sup>115</sup>.

### ***Acting Globally***

In addition to the ones already mentioned, a number of initiatives benefit from international support. These include:

- Turkey-United States Economic Partnership Commission Action Plan;
- Energy Conservation in Industry;
- Energy Efficiency in Buildings in Erzurum;

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112 European Commission, 2005 (Chapter 5 – Public procurement)

113 IEA, 2005

114 [http://ec.europa.eu/enlargement/fiche\\_projet/document/PF%202005%2003.08%20Energy%20Efficiency.pdf](http://ec.europa.eu/enlargement/fiche_projet/document/PF%202005%2003.08%20Energy%20Efficiency.pdf)

115 European Commission, 2007: EU Energy Policy and Turkey. MEMO/07/219

- Environmental Improvement Projects;
- IEA Implementing Agreements;
- Other funds for energy efficiency;
- EU 6<sup>th</sup> Framework programme;
- UNFCCC and carbon transactions.

#### *Turkey-United States Economic Partnership Commission Action Plan*

In the context of the Turkey-United States Economic Partnership Commission Action Plan, the U.S. Department of Energy will work with the Turkish Ministry of Energy and Natural Resources to co-sponsor and co-host a workshop on clean coal technologies, or energy efficient/earthquake resistant housing technologies<sup>116</sup>.

#### *Energy Efficiency in Buildings in Erzurum*

GTZ, the German organisation for technical assistance, provided technical assistance to the project on 'Energy Efficiency in Buildings in Erzurum'. The project, implemented in 2002–2005, had the following components: capacity building of EIE/NECC and Erzurum municipality, energy managers training, other target group trainings, demonstration projects; and legislative review concerning the building sector at both national and local level<sup>117</sup>.

#### *Environmental Improvement Projects*

The project, by the German cooperation bank KfW (Kreditanstalt für Wiederaufbau), started in 2003 and provided SMEs with funds for energy saving investments with due consideration to the environmental performance of industrial companies<sup>118</sup>.

#### *IEA Implementing Agreements*

Turkey participates in a number of Implementing Agreements in the context of the IEA Framework for International Technology Co-operation, such as: Energy conservation in buildings and community systems programme (ECBCS), Energy conservation through energy storage, Energy technology systems analysis programme (ETSAP), Hydrogen, and Photovoltaic power systems<sup>119</sup>.

#### *Other funds for energy efficiency*

Various international organisations and donors, such as the United Nations Industrial Development Organization (UNIDO), the World Bank, the EU, the GTZ (Deutsche Gesellschaft für Technische Zusammenarbeit) and the Japan International Cooperation Agency (JICA) have provided

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116 [http://turkey.usembassy.gov/news\\_052507.html](http://turkey.usembassy.gov/news_052507.html)

117 [http://ec.europa.eu/enlargement/fiche\\_projet/document/TR%200303.06%20Improvement%20of%20energy%20efficiency.pdf](http://ec.europa.eu/enlargement/fiche_projet/document/TR%200303.06%20Improvement%20of%20energy%20efficiency.pdf)

118 [http://ec.europa.eu/enlargement/fiche\\_projet/document/TR%200303.06%20Improvement%20of%20energy%20efficiency.pdf](http://ec.europa.eu/enlargement/fiche_projet/document/TR%200303.06%20Improvement%20of%20energy%20efficiency.pdf)

119 IEA, 2005

financing for energy efficiency projects and programmes in Turkey. These activities were mostly technical in nature and focused on energy audits, staff training and energy efficiency policy development<sup>120</sup>.

#### *UNFCCC and carbon transactions*

As a member of the OECD, Turkey was included among the Annex I and II countries when the UNFCCC was adopted in 1992. In 2001 Turkey was removed from the list of Annex II countries, but remained on Annex I - with an accompanying footnote specifying that Turkey enjoys favourable conditions. Furthermore, Turkey was not given a quantified emissions reduction target in the Kyoto Protocol, as it was not a party of the UNFCCC by the time the protocol was adopted in 1997. Turkey enacted the UNFCCC in 2004, but has not yet signed the Kyoto Protocol; hence it is not eligible for CDM and JI. Turkey though can undertake carbon transactions with other countries. The first transaction took place in 2006, when a German company purchased Verified Emission Reductions (VERs) certificates from a Turkish wind power plant<sup>121</sup>.

### **country Synthesis**

#### ***Trends in R&D expenditure in Turkey***

Historically Turkey has made limited investments, as a percentage of GDP, in research and development (including environmental innovation). More emphasis though was put on R&D after 2005, as more ambitious objectives for investment were set - although lower than the EU Lisbon target. Security of energy supply was identified by the government as one of the main objective for the national R&D activities. A number of initiatives hence are targeted on renewable sources and energy efficiency.

The Gross Expenditure on Research and Development (GERD) as a percentage of GDP was 0.72 in 2001, 0.66 in 2002<sup>122</sup> and 0.67 in 2004<sup>123</sup>.

In 2005 Turkey decided to gradually increase the GERD as a percentage of GDP to 2 per cent in 2010, to increase private expenditure on R&D as a percentage of GERD from 28.7% (2002) to 50% and to raise the number of full-time equivalent researcher from around 24,000 up to 40,000, all within the same period of time<sup>124</sup>. The 2 per cent objective though is still below the EU Lisbon target of 3 per cent GERD/GDP. According to the OECD data, the share of GERD financed by industry is decreasing, from 41 to 38%.

Due to this increased commitment in R&D, the research funds during the 2000-07 period increased significantly, from €106 million in 2000 to €761 million in 2007. The total amount of funds allocated for 2005, 2006 and 2007 is €2249 million as opposed to €1077 million set aside for five

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120 IEA, 2005

121 <http://www.3c-company.com/en/press-events/press-releases/press-release/news/2006/07/10/first-turkish-carbon-transaction-between-bilgin-energy-and-3c-climate-change-consulting.html>

122 OECD, 2007: Country statistical profiles 2007  
<http://stats.oecd.org/wbos/viewhtml.aspx?queryname=334&querytype=view&lang=en>

123 European Commission, 2006

124 European Commission, 2005 (Chapter 5 Science and research)

years between 2000 and 2004<sup>125</sup>. The figures also indicate a sharp increase in TÜBİTAK's industrial research and development support (€54 million in 2004, up from €25 million in 2000). The number of bilateral agreements on cooperation in science and technology, with a total of 60 countries, reached 100<sup>126</sup>.

### ***Lessons learnt***

Turkey is in the process of becoming a candidate to the EU, and hence in the position to transpose and implement the EU *acquis*. This leads to a significant amount of uptake of environmental technologies and systems (although not necessarily 'innovative' compared to EU standards), as Turkey needs to put in place or renovate environmental infrastructures – like water and waste water systems, waste facilities - transport infrastructures, etc. Potential EU accession is one of the most important drivers for the uptake of these innovations in Turkey.

The Supreme Council for Science and Technology (BTYK) and Scientific and Technological Research Council of Turkey (TUBİTAK) are key institutions to set long term strategies, co-ordinate and carry on research and development initiatives in science and technology.

A number of initiatives set energy efficiency standards, especially in buildings. Many initiatives are also focused on water resources, both for electricity production (small and large hydro) and for resource use efficiency (e.g. irrigation), water being a scarce resource in Turkey. Turkey has a large potential for renewable sources (especially hydro, solar, geothermal).

Many initiatives on environmental innovation enjoy the support of other industrialised countries (like Japan and Germany) through technology transfer, training and international conferences. Also, the potential candidature to enter the EU gave Turkey access to EU pre-accession funds. Some infrastructural projects have also benefited from World Bank loans.

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125 <http://cordis.europa.eu/erawatch/index.cfm?fuseaction=ri.content&topicID=329&countryCode=TR&parentID=50>

126 European Commission, 2005b

## Appendices

### Summary table

Actions	Initiatives
Research and Development	Coal Bed Methane Mitigation Research Working groups on energy technologies Support Programme for Scientific and Technological Research Projects
Performance Targets	Energy Efficiency Law - No. 5627 Labelling of Household Electrical Appliances Energy Efficiency in Public Buildings and Street Lighting Regulation on Heat Insulation in Buildings Labelling of Passenger Car Fuel Economy and CO <sub>2</sub> Emissions Industrial Air Pollution Control Regulation Gasoline and Diesel Oil quality Regulation
Mobilisation of Financing	Greater Southeastern Anatolia Project (GAP) Turkey Emergency Flood Earthquake Rehabilitation (TEFER) Energy-Environment in Turkey World Bank Renewable Energy Project
Market-based Instruments and State Aid	Electricity Market Licensing Regulation Law on Utilization of Renewable Energy Resources for the Purpose of Generating Electrical Energy
Awareness Rising and Training	Industrial energy manager courses with JICA EIE/NECC awareness raising initiatives
Acting Globally	Regional Environmental Center (REC) Turkey initiatives Turkey-United States Economic Partnership Commission Action Plan Industrial energy manager courses – with JICA (ch. 2.6) Energy Conservation in Industry Energy Efficiency in Buildings in Erzurum Environmental Improvement Projects IEA Implementing Agreements Other funds for energy efficiency EU 6 <sup>th</sup> Framework programme UNFCCC and carbon transactions
Other initiatives	Road Transport Law no 4925 Pilot projects on alternative transport fuels

**Reference and data sources**

The sources of information and contact details related to this report are listed below.

Commission Decision C(2007)1835 of 30/04/2007 on a Multi-annual Indicative Planning Document (MIPD) 2007-2009 for Turkey  
([http://ec.europa.eu/enlargement/pdf/mipd\\_turkey\\_2007\\_2009\\_en.pdf](http://ec.europa.eu/enlargement/pdf/mipd_turkey_2007_2009_en.pdf))

European Commission: Standard Summary Project Fiche - Project number: TR 05 03.08  
([http://ec.europa.eu/enlargement/fiche\\_project/document/PF%202005%2003.08%20Energy%20Efficiency.pdf](http://ec.europa.eu/enlargement/fiche_project/document/PF%202005%2003.08%20Energy%20Efficiency.pdf))

European Commission: Standard Summary Project Fiche - Project number: TR 0303.06 - Twinning number: TR03-EY-01  
([http://ec.europa.eu/enlargement/fiche\\_project/document/TR%200303.06%20Improvement%20of%20energy%20efficiency.pdf](http://ec.europa.eu/enlargement/fiche_project/document/TR%200303.06%20Improvement%20of%20energy%20efficiency.pdf))

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([http://ec.europa.eu/enlargement/turkey/screening\\_reports\\_en.htm](http://ec.europa.eu/enlargement/turkey/screening_reports_en.htm))

European Commission, 2007: EU Energy Policy and Turkey. MEMO/07/219

European Commission, 2005(b): Turkey 2005 Progress Report. COM (2005) 561 final  
([http://ec.europa.eu/enlargement/archives/pdf/key\\_documents/2005/package/sec\\_1426\\_final\\_progress\\_report\\_tr\\_en.pdf](http://ec.europa.eu/enlargement/archives/pdf/key_documents/2005/package/sec_1426_final_progress_report_tr_en.pdf))

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(<http://cordis.europa.eu/erawatch/index.cfm?fuseaction=ri.countryReport&countryCode=TR&rintme=1>)

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IEA , 2005: Energy Policies of IEA Countries – Turkey 2005 Review, Paris, France

Reorganization of the State Planning Organization; decided by the Council of Ministers on 19.06.1994 based on the authority accorded by the Law No.4004, dated 16.06.1994  
(<http://mevzuat.dpt.gov.tr/khk/540/spo.html#object>)

State Planning Organisation: 2007 Annual Programme (<http://ekutup.dpt.gov.tr/program/2007i.pdf>)

OECD, 2007: Country statistical profiles 2007  
(<http://stats.oecd.org/wbos/viewhtml.aspx?queryname=334&querytype=view&lang=en>)

World Bank, 2005: Project Performance Assessment Report Turkey - Erzincan Earthquake Rehabilitation and Reconstruction Project (L3511-TR) - Turkey Emergency Flood and Earthquake Recovery Project (L4388-TR) - Emergency Earthquake Recovery Project (L4518-TR). Report No. 32676-TR

<http://www.oecd.org/dataoecd/9/56/35297981.pdf>

## COUNTRY PROFILE OF THE US

### **Introduction and country definitions of eco-innovation**

#### ***Definitions related to eco-innovation used in the Country***

‘Environmental innovation’ or ‘clean technology’ (cleantech) is more often used in the US than ‘eco-innovation’. The Environmental Protection Agency considers that today’s environmental challenges require new approaches. It fosters innovation and collaboration. It approaches environmental innovation as a result-oriented, collaborative endeavour. The emphasis is both on innovation in the *regulatory approaches*, and in *technologies or techniques* for environmental protection.

Innovative regulatory systems include pilot testing flexible air permits, offering regulatory incentives for environmental improvements, innovative ways to regulate small businesses (through an integrated system of compliance assistance, self-certification procedures and statistically based performance measurement). USEPA supports regulatory innovation at State level as well. The Innovation Toolkit for EPA Rulewriters provides a framework for and examples of innovative approaches in the regulatory process; the competitive State Innovation Grant Programme provides funding to help states explore innovative approaches in three areas of mutual interest, namely environmental permitting, environmental management systems and performance-based leadership programmes.

Environmental technology development also benefits from government’s support. Major amendments to the most important environmental laws (Clean Air Act, Clean Water Act, Federal Insecticide Fungicide and Rodenticide Act, etc.) have enhanced and, in some cases, expanded the environmental mandate. Some provisions of these laws provide new tools for achieving environmental results, and some of these new tools rely on technology and market forces.

#### ***Institutions playing a major role on eco innovation***

A number of federal agencies support eco-innovation, often in a collaborative way. States play a crucial part. Some institutions have been created to steer work in particular areas.

#### ***US EPA***

EPA’s strategic plan 2006-2011 entails three principles, or cross-cutting themes. One is innovation and collaboration, with the aim to promote a sense of environmental stewardship and shared responsibility for addressing environmental challenges. Another one is the use of best available science, to anticipate threats and opportunities.

In 2002, EPA released a comprehensive strategy to drive innovation in environmental programs. EPA’s innovation strategy is based on the idea that future environmental protection systems will rely less on technology requirements and more on strategies tailored to address the needs of whole facilities, communities, or industry sectors. The strategy targets a set of priority problems: reducing

greenhouse gases and ozone, restoring water quality and addressing the funding gap for water infrastructure. All types of options are considered (regulations, policy, guidance, voluntary initiatives and compliance assistance). The strategy focuses on developing tools that will expand current capabilities, for example by supporting environmental technology innovation. This entails in particular creating a culture and organisational systems to foster innovation at the Agency.

EPA has established an Innovation Action Council, a senior-level policy forum which develops an innovation work plan, oversees and reports on innovation progress. States participate in the Council.

Efforts to boost innovation are coordinated through the National Center for Environmental Innovation (NCEI), which describes its role as follows: “NCEI is working to bring about the next generation of environmental protection, one that focuses more on results and less on process; emphasizes environmental protection, not just pollution control; and takes a comprehensive rather than piecemeal approach to problem-solving. This environmental protection system we envision - and are working toward - would use more market-based incentives that link environmental and economic objectives. It would also provide better information and meaningful opportunities for public involvement in decision-making”.

NCEI works at firm, sector, community level; it collaborates with states and tribes as well; it runs a network of 10 regional offices. Partnership with colleagues in the EPA or with other public or private sector organisations is a major feature of NCEI’s strategy, as it fosters leveraging resources and sharing experience.

#### *US Department of Energy*

The Department of Energy is an important player in the development of energy technologies. In particular, it has initiatives in the field of fossil fuel (carbon sequestration from coal plants), energy efficiency (e.g. it is responsible for developing energy efficiency standards) and renewables.

The DoE presents itself as a holding, with ten programmes focused on technologies. For each programme, its mission is to find ways to develop and commercialise technologies developed in national laboratories so that they become cost competitive. National laboratories administered by DoE are incentivised to actively promote their technologies; for instance, laboratories are allowed to take an equity share in the companies that commercialise the results of their research. Major projects involve demonstration at a production (not pilot) scale.

The Department works with other agencies, universities and venture capital companies (to understand what it would take to lower the risk from an investor’s perspective). It operates a number of instruments with a view to lower the risks for investors: commercialisation funds, loan guarantees (to subsidise the cost of capital for large scale project development), entrepreneurship residence programmes (to create incentives for venture capital firms to come in the laboratories); it showcases best technologies to venture capital firms.

#### *The U.S. Department of Defence*

DoD has a strong action on the field of environment and sustainability in general. This entails buildings, vehicle fuel and energy. Research is involved.

In particular, DoD operates the Strategic Environmental Research and Development Program ([www.serdp.org](http://www.serdp.org)), planned and executed in full partnership with the Department of Energy and the

Environmental Protection Agency, with participation by numerous other federal and non-federal organizations. To address the highest priority issues confronting the Army, Navy, Air Force, and Marines, SERDP focuses on cross-service requirements and pursues high-risk/high-payoff solutions to the Department's most intractable environmental problems. The development and application of innovative environmental technologies support the long-term sustainability of DoD's training and testing ranges as well as significantly reduce current and future environmental liabilities in the US (forts) and abroad.

#### *US Department of Agriculture*

USDA plays a major role on eco-innovation for renewables, biofuels and bio-products. It cooperates with other agencies, such as USEPA and more recently with DoE.

At the turn of the century, USDA had initiated work on biomass and energy. The Energy Title of the Farm Bill, in 2002, invited USDA to put more emphasis on energy (solar, wind, biofuels). The issue of rural development is another entry point.

Support to eco-innovation spreads all along the technology continuum; the instruments depend on the maturity of the technologies. Typically, USDA supports basic research on feedstock supplies and on logistical issues (with concerns about scale, etc.); direct public funding and tax rebates are essential instruments at this stage. In the case of anaerobic digestion, the thrust is on demonstrating the technology. For more robust technologies, the priority is market access. The effort is shifting from initial emphasis on R&D to deployment.

#### *The National Science Foundation*

The Foundation supports basic science research and education. A wide array of proposers is eligible, including universities and colleges, non-profit, non-academic organisations, for-profit organisations (in particular SMEs), states and local governments. Proposals are assessed on the basis of two merit review criteria: the intellectual merit of the activity, the broader impacts of the activity (in particular in terms of teaching, training and learning, access to underrepresented groups, infrastructure for research and education, dissemination, benefits for the society).

The Foundation has an Environmental Research and Education division which is relevant to eco-innovation (<http://www.nsf.gov/geo/ere/ereweb/about.cfm> ). It is particularly active in nanomaterials and water.

#### *States*

States are engaged in environmental innovation and related policy, including through the Environmental Council of the States ([www.ecos.org](http://www.ecos.org) ). They approach eco-innovation either through an environmental or an economic development perspective (e.g. Mississippi considers turning its economy into a biofuel economy, in the aftermath of Katrina). Under certain circumstances, they can act on their own standards.

#### ***Policy documents related to eco-innovation***

The Energy Independence and Security Act was signed in December 2007. It consists mainly of provisions designed to increase energy efficiency and the availability of renewable energy. It is consequential for eco-innovation policies in the US. The three key provisions are the Corporate

Average Fuel Economy (CAFE) Standards, the Renewable Fuel Standard (RFS), and the appliance/lighting efficiency standards (see details on [energy.senate.gov](http://energy.senate.gov)):

- Corporate Average Fuel Economy (CAFE) Standards. The law sets a target of 35 miles per gallon for the combined fleet of cars and light trucks by model year 2020. Also, fuel economy programs are established for trucks;
- Renewable Fuel Standard (RFS). The law sets a modified standard that starts at 9.0 billion gallons of renewable fuel in 2008 and rises to 36 billion gallons by 2022. Of the latter total, 21 billion gallons is required to be obtained from advanced biofuels;
- Appliance and Lighting Efficiency Standards. Energy efficiency standards are set for broad categories of lamps. A required target is set for lighting efficiency, and energy efficiency labeling is required for consumer electronic products. Also, efficiency standards are set by law for a number of appliances. Further, Department of Energy is directed to set standards by rulemaking for furnace fans and battery chargers.

Some of the most relevant policy documents for eco-innovation are mentioned below:

- National Center for Environmental Innovation, 2004: report on progress (most recent one issued, at <http://www.epa.gov/innovation/aboutncei.htm>); most of EPA related literature can be found at <http://www.epa.gov/etop/>;
- A new generation of American Innovation: a presidential initiative announced by President Bush on April 26, 2004. Among its aspects are ‘Providing a cleaner more secure energy future through hydrogen fuel technology,’ with funding channelled through the DOE;
- American Competitiveness Initiative: announced by President Bush in his 2006 State of the Union address. Among its goals are: ‘Overcoming technological barriers to efficient and economic use of hydrogen, nuclear, and solar energy through new basic research approaches in materials science (DoE, NSF, NIST);
- The National Energy Policy Act contains a large number of items relevant to promoting innovative energy;
- The US Department of Energy Strategic Plan.

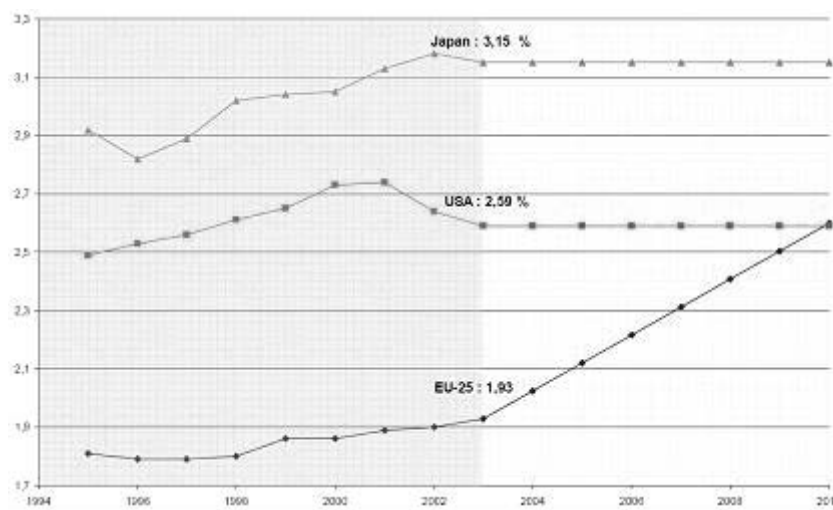
**Policies, Initiatives and instruments – a national inventory**

***Research and Development***

*Statistics on R&D in the United States*

The overall picture of United States research and development (R&D) budgets (for all types of R&D) is one of high expenditure compared to the EU, but lower than in Japan.

**Figure 7. R&D budgets in US, Japan and the EU**



Source : <sup>127</sup>

In terms of science and technology budgets, the US is in the lead overall, but if one limits the calculation to non-defence spending, it falls behind the EU.

Specific government R&D expenditure on eco-innovation does not appear to be available in summary form, though the Rand Corporation maintains a database of US R&D funding. It describes the US R&D situation as the following (from [https://radius.rand.org/radius/federal\\_rd.html](https://radius.rand.org/radius/federal_rd.html)):

In recent years, the U.S. Federal Government has spent over \$100 billion annually to support the “conduct of R&D” in government laboratories, colleges and universities, private firms, and other entities. Although this \$100+ billion represents only a small proportion of the total federal budget each year, it comprises approximately 14% of annual federal discretionary spending.

Thos budget is allotted to 22 federal agencies. Six federal agencies control 95% of these funds: Department of Defense, Department of Health and Human Services, National Aeronautics and Space Administration, Department of Energy, National Science Foundation, Department of Agriculture.

The section below features some of the major initiatives from USEPA, DoE, USDA and from States and local governments.

<sup>127</sup> data after 2004 are projections

*EPA research programmes*

EPA's research programmes cover the whole technology continuum, from basic research and proof of concept to full-scale commercialisation and utilisation (see EPA Environmental Technology Research & Development Continuum).

The **intramural research programme** helps to understand the key drivers of environmental systems and provides the fundamental scientific basis for addressing a wide variety of environmental problems. This programme follows multiyear research plans that set out research goals for the next 5-10 years. It is managed by the EPA Office of Research and Development (ORD). ORD states that its mission is to:

- Perform research and development to identify, understand, and solve current and future environmental problems.
- Provide responsive technical support to EPA's mission.
- Integrate the work of ORD's scientific partners (other agencies, nations, private sector organizations, and academia).
- Provide leadership in addressing emerging environmental issues and in advancing the science and technology of risk assessment and risk management.

The ORD has eight priority areas: Air, Drinking Water, Ecosystem Assessment and Restoration, Global Change, Human Health Protection, Water Quality, Pollution Prevention and New Technologies, Endocrine Disrupting Chemicals.

**The Science to Achieve Results (STAR) program** is a competitive grant program that funds research grants and graduate fellowships for extramural research in environmental science and engineering for universities and non-profit organization. It complements intramural R&D and the programmes of those of four federal agency partners.

In addition to ORD, EPA is involved in a number of collaborative R&D programmes with the industry. The **Clean Automotive Technology Programme** is an illustration: EPA conducts innovative research in collaboration with the automotive industry to achieve ultra-low pollution emissions, increase fuel efficiency and reduce greenhouse gases. The programme encourages manufacturers to produce cleaner and more fuel-efficient vehicles.

*The US Department of Energy initiatives*

The National Laboratory system is under the jurisdiction of the US DoE. An overview of R&D is available at <http://www.osti.gov/EnergyFiles/research.html>.

The following DOE laboratories conduct research and development of energy efficiency and renewable energy technologies (the list is not comprehensive):

- The Albany Research Centre specialises in life-cycle research of metals, alloys and ceramics; it is particularly active in technology transfer and is involved in cooperative research partnerships;
- Ames Research Centre explores the development and use of new materials;

- Argonne National Laboratory has R&D activities on energy resources programs (developing advanced batteries and fuel cells and advanced electric power generation and storage systems), on environmental management. It is actively involved in moving benefits from research to industry;
- Brookhaven National Laboratory has a department focusing on waste technology and working on hazardous materials management problems;
- Idaho National Engineering and Environmental Laboratory is the lead laboratory in environmental management (including managing US nuclear waste). A part from R&D in nuclear energy, INEEL is also involved in research in energy efficiency and renewable energy and fossil energy (developing solutions to the environmental problems of the US petroleum industry);
- National Renewable Energy Laboratory; NREL has an entrepreneurial section in its organisation, which provides resources for technology commercialisation (including a network of incubators, see below); it organises Industry growth Forums, which bring together start-up clean energy companies, venture capitalists and senior business executives to catalyse learning about business growth strategies and facilitate strategic business partnerships;
- Sandia National Laboratories; it has a section devoted to the development of small businesses and runs a number of projects to facilitate development projects.

#### *US Department of Agriculture*

The Department has an R&D programme, sometimes via extension of funding to other agencies. For instance, the Department of Energy has responsibility to make loans but lacks the organisation to manage them. DoE has brought USDA in for the assessment process. Under the Biomass R&D Act, USDA and DoE jointly decide on a set of projects that will be funded.

The Department runs a Cooperative R&D Agreement programme (CREDA), through which it supports public-private partnerships in environmental R&D: the public sector provides equipment and human resources. Under such agreements, the private sector can access outcomes of federal research.

#### *State and Local R&D initiatives*

States support R&D via the universities they support. They also take a number of initiatives, essentially bridging the gap between research and markets, often in collaboration:

- The **California Public Interest Energy Research (PIER) Program** supports research and development (R&D) in energy technologies through direct research grants totalling up to \$62 million annually;
- California's **Innovative Clean Air Technologies (ICAT) funds** are used to help businesses bridge the funding deficit between research and wide-scale deployment. ICAT funds technically solid projects that can demonstrate the commercial utility in California of technical innovations that will improve emission prevention or control;
- **Incubators** are targeted to improving the survival of new companies, and moving products to market. An example is the city of Austin's Clean Energy Incubator, which is a program in

cooperation with the National Renewable Energy Laboratory, the Texas State Energy Conservation Office, and Austin Energy. The **Clean Energy Alliance** is an alliance of leading business incubators dedicated to providing business and financial services tailored to the needs of the clean energy community. It was established in 2000 by the National Renewable Energy Laboratory (NREL), the US primary laboratory for renewable energy and energy efficiency research and development. NREL's mission and strategy are focused on advancing the U.S. Department of Energy goals. It is noteworthy that NREL has forged a focused strategic direction to increase its impact by accelerating the research path from scientific innovations to market-viable alternative energy solutions.

- There is also the **Connecticut Clean Energy Fund (CCEF)**, operational since 2000. It makes equity investments in companies ‘whose products and services will accelerate the development of clean energy technologies, including fuel cells, solar, wind, biomass, wave/ocean technologies, and green buildings.’ (Stack, 2007).

### *Verification of technologies*

Verification is the subject of Environmental Technology Verification (ETV) program, a dedicated programme at the EPA (see <http://www.epa.gov/etv/>). The program started in the mid 1990s, and is designed to reduce uncertainty around new technologies and to increase their acceptance, by offering third-party information on technologies so that potential purchasers are not relying on the claims and data of the vendors alone: it provides performance information which is critical to EPA, other government agencies (at federal, state and local levels), and purchasers of innovative environmental technologies.

The EPA’s ETV program has been in a pilot phase until 2000. From 2001 it has been in full implementation. Since 1995, and as of May 2008, 403 technologies have been verified and 90 verification protocols have been defined in six areas, each run by a different institution.

Federal funding to ETV is decreasing and more resources have to come from the verifications themselves.

In its May 2007 report, the National Advisory Council on Environmental Policy and Technology encourages EPA to expand technology verification programmes across the world.

### *Performance Targets*

Performance targets are contained in major regulations like the Clean Air Act and Clean Water Act, governing permissible emissions levels for pollutants, or the Energy Independence and Security Act (which includes a zero net energy initiative to develop technologies, practices and policies to reach the goal of having all commercial buildings use no net energy by 2050). These have been driving environmental innovation. Performance targets in the US include:

- Clean Air act and Clean Water Act
- Corporate Average Fuel Economy (CAFE) regulations
- National Performance Track
- Federal Renewable Fuels Standard
- Minimum standards of energy efficiency
- EnergySTAR
- Natural Gas STAR
- Energy Policy Act of 2005

- Executive Order 13423
- California's Greenhouse Gases Emission Performance Standard Act
- California Low Carbon Fuel Standard (LCFS)
- Renewables Portfolio Standards
- Efficiency standards on household appliances

Other environmental legislation with targets for environmental media (and, hence, technology standards), also include the Resource Conservation and Recovery Act (RCRA), the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), the Toxic Substances Control Act (TSCA), and the Safe Drinking Water Act (SDWA).

#### *Federal initiatives*

##### Clean Air act and Clean Water Act

Innovation credited to the provisions of the Clear Air Act and its amendments include improved SO<sub>2</sub> control technologies, Selective Catalytic Reduction technology and ultra-low NO<sub>x</sub> burners, mercury control technologies and VOC controls, among others (Saha et al., 2005).

##### Corporate Average Fuel Economy (CAFE) regulations

Another example is the CAFE regulation, which set required limits for fleet fuel usage. Since 2003, the government has finalized two sets of revisions, requiring a combined 15 percent increase in the fuel economy of light trucks.

##### National Performance Track

More recently there are new approaches to targets, focused on *exceeding regulatory requirements through voluntary action*. The main example was the EPA's Project XL: voluntary performance standards, a pilot that led to the National Environmental Performance Track, under the EPA office of Policy, Economics and Innovation. Performance Track recognizes environmental stewardship and drives environmental excellence by encouraging facilities with strong environmental records to go above and beyond their legal requirements.

Facilities applying to Performance Track must meet the following criteria:

- Applicants must have an Environmental Management System in place for at least one complete cycle;
- Performance Track members have a record of compliance with environmental laws and are in compliance with all applicable environmental requirements;
- Applicants must demonstrate past environmental achievements during the current and preceding year. Applicants also commit to four quantitative goals for improving their environmental performance;
- Applicants commit to remain involved and active in their community, sharing their accomplishments with the public and addressing any community concerns.

In return, Performance Track:

- acknowledges member facilities locally and nationally through letters to elected officials, trade journal articles, press releases, case studies, *P-Track News*, member listings on the website, and Performance Track Awards.
- provides networking opportunities through Annual Member Events, regional roundtables, teleseminars, EPA meetings, joint workshops with Performance Track partners, and meetings of the Performance Track Participants' Association.
- works with states and other stakeholders to provide specific regulatory and administrative benefits, such as reduced self-reporting and low-priority status for routine federal inspections.
- encourages Performance Track facilities to take advantage of services such as the Green Suppliers Network Review or the Performance Track Mentoring Program.

Leading financial advisory firms use Performance Track data in their research methods. This practice can benefit top-performing, publicly traded companies, making them more attractive to investors and increasing brand recognition.

EPA claims the programme has helped to transform EPA's relationship with the regulated community, fostering a more collaborative and constructive dynamic. In 2006, 470 facilities had earned membership.

A similar programme is focused on greenhouse gases: Climate Leaders is an EPA industry-government partnership that works with companies to develop comprehensive climate change strategies. Partner companies commit to reducing their impact on the global environment by completing a corporate-wide inventory of their greenhouse gas emissions based on a quality management system, setting aggressive reduction goals, and annually reporting their progress to EPA. Through program participation, companies create a credible record of their accomplishments and receive EPA recognition as corporate environmental leaders.

#### Federal Renewable Fuels Standard

The federal Renewable Fuels Standard, established by the 2005 Energy Policy Act, requires that U.S. vehicles consume a minimum of 7.5 billion gallons of renewable fuel annually by 2012 – up from about 1.8 billion gallons in 2001.

#### Minimum standards of energy efficiency

Minimum standards of energy efficiency for many major appliances were established by the U.S. Congress in the Energy Policy and Conservation Act (EPCA) of 1975, and had been subsequently amended by succeeding energy legislation, including the Energy Policy Act of 2005 and the Energy Independence and Security Act in 2007.

Two federal programmes recognise equipment and techniques reaching high standards (text from [www.whitehouse.gov/ceq](http://www.whitehouse.gov/ceq)):

- EnergySTAR: in cooperation with more than 8,000 private and public sector organizations, the program identifies and promotes energy-efficient products to reduce greenhouse gas

emissions. The Energy STAR label is now on major appliances, office equipment, lighting, home electronics, and more. EPA has also extended the label to cover new homes and commercial and industrial buildings. For more information visit <http://www.energystar.gov>.

- Natural Gas STAR: this is a flexible, voluntary partnership between EPA and the oil and natural gas industry. Through the Program, EPA works with companies to identify and promote the use of cost-effective technologies and practices to reduce emissions of methane. As of 2005, the companies participating in Natural Gas STAR represent 56 percent of the natural gas industry in the U.S. Today, the program has over 110 partner companies and is endorsed by nearly 20 major industry trade associations. For more information visit <http://www.epa.gov/gasstar>.

The Federal Government is also establishing requirements for performance of its own facilities (see also the procurement section below):

- Energy Policy Act of 2005: it established requirements for Federal agencies to, among other things, decrease energy consumption at Federal facilities by over 2% per year for 10 years ([www.whitehouse.gov/ceq](http://www.whitehouse.gov/ceq)).
- Executive Order 13423, Strengthening Federal Environmental, Energy, and Transportation Management, was signed by the President on January 24, 2007. It establishes total energy reduction goals for every Federal agency, reaching 30% reduction in energy intensity by 2015.

#### *State and local standards and targets*

##### California's Greenhouse Gases Emission Performance Standard Act

The Act (SB1368) effectively prevents the production or import of coal-fired power; although there is almost no coal power in California, there is in neighbouring states and more is planned, largely for export to California – this law means they will have to find cleaner options.

##### California Low Carbon Fuel Standard (LCFS)

It is a requirement to reduce transport related GHG emissions by 10 per cent by 2020.

##### Renewables Portfolio Standards

Renewables Portfolio Standards are an increasingly popular way of promoting renewables in various states around the US:

- *California*: 20% renewable power by 2010
- *Illinois*: 5% by 2010, with a goal of 15% by 2020
- *Nevada*: 20% by 2015
- *New Jersey*: 20% by 2020
- *New Mexico*: 10% by 2011
- *New York*: 25% by 2013
- *Pennsylvania*: 18% by 2020
- *Rhode Island*: 16% by 2019
- *Texas*: 2.15% renewables in 2005, 3% by 2009.

## Efficiency standards on household appliances

Arizona, California, Connecticut, Maryland, New Jersey and New York have imposed efficiency standards on household appliances not covered by national law. The latest is New York, where the Appliance and Equipment Energy

Efficiency Standards Act of 2005 addresses refrigerators, washing machines and other major energy users in the home, as well as standby power.

### ***Mobilisation of Financing***

In this section, major federal initiatives are accounted for (, The Energy Policy Act of 2005, Renewable Electricity Production Credit, Volumetric Ethanol Excise Tax Credit), as well as several state-level initiatives and programmes.

A feature of the US framework conditions to support eco-innovation is the presence of an active venture apital community. EPA has recently investigated how the resources from this community could more systematically be harnessed.

### *Harnessing private finance and the venture capitalists*

Recognizing that EPA's goals can be advanced with more new and effective technologies in the market place, EPA asked NACEPT to seek the investment community's advice on what actions EPA and the investment community could take, and what partnerships they could create, to boost private-sector investment in the commercialization of environmental technologies over the long-term.

In its report, NACEPT urges EPA to consider the following six recommendations:

1. Recognize carbon dioxide, greenhouse gases, and climate change-related pollutants as pollutants that are addressed in Goal 1 of EPA's Strategic Plan (Clean Air and Global Climate Change\*) and take priority measures within EPA's authority to establish standards and long-term regulations for these pollutants.
2. Forge and sustain communications with the early-stage investment community.
3. Strengthen financial support (e.g., loan guarantees, grants, revolving loan funds) and reduce regulatory risks for new technology development during the commercialization period.
4. Take steps to streamline permitting for commercial scale-up of new, innovative environmental technologies.
5. Enforce environmental regulations consistently to clarify needs and avoid uncertainty.
6. Support metrics and monitoring of new technologies.

The report claims that with the strong investment interest today in energy and environmental technology, EPA also can spur development and implementation of needed new technology by helping to provide a more predictable regulatory framework for greenhouse gas emissions.Federal Renewable Energy incentives

## The Energy Policy Act of 2005

The Energy Policy Act authorized \$5 billion over five years in tax incentives to encourage investments in energy efficiency and alternative renewable energy sources. The new energy law provides new performance-based tax credits of up to \$3,400 for the most highly fuel efficient vehicles such as hybrids and clean diesel.

Tax incentives are only one source of incentives. The Department of Energy's Office of Energy Efficiency and Renewable Energy runs grant programs for demonstration projects for energy efficiency and renewable energy ([www.eere.energy.gov](http://www.eere.energy.gov)).

The Energy Independence and Security Act (2007) authorizes state energy grants to address state's energy priorities and adopt emerging renewable energy and energy efficiency technologies through Fiscal Year 2012. It establishes an Energy and Environment Block Grant to be used for seed money for innovative local best practices to fund local initiatives, including building and home energy conservation programs, energy audits, fuel conservation programs, building retrofits to increase energy efficiency, "Smart Growth" planning and zoning, and alternative energy programs ([EnergyPriorities.com](http://EnergyPriorities.com)).

## Renewable Electricity Production Credit (REPC)

EPACT also extended the REPC, which is a per kilowatt-hour tax credit for electricity generated by qualified energy resources. Electricity from wind, closed-loop biomass and geothermal receives a tax credit of 1.9 cents/kWh. Electricity from open-loop biomass, small irrigation hydroelectric, landfill gas, municipal solid waste resources, and hydropower receives 1.0 cent/kWh.

## Volumetric Ethanol Excise Tax Credit (VEETC)

Biofuels are supported by the federal Volumetric Ethanol Excise Tax Credit of \$0.51 per gallon to ethanol producers and \$1 per gallon for renewable biodiesel producers. There is also a \$0.54 per gallon tariff on ethanol imports protecting domestic producers.

## *State and local Initiatives*

There are many programmes at state level to finance research into clean technologies –like California's Public Interest Energy Research (PIER) program and the New York State Energy Research and Development Authority (NYSERDA). These "public benefits" programs are typically financed by tax dollars or surcharges on rate payers.

The California Solar Initiative (CSI) is a \$3.3 billion programme to help offset the cost of installing residential PV through capital grants, with the amount linked to the expected performance of the unit, and a 10% reduction per year, to spur innovation and cost reduction.

Also in California the two largest public pension funds in the country, CalPERS and CalSTERS, along with the state Treasurer's office, have launched the Green Wave Initiative in 2004, setting aside \$450 million of capital to invest in cleantech companies.

Boulder, Colorado has imposed a tax on fossil fuel power for electricity sold in the city. The revenue will be invested by the city in clean energy and transport.

Colorado, Connecticut, the District of Columbia, Illinois, Louisiana, Maine, New Mexico, New York, Oregon, Pennsylvania, South Carolina and Utah offer preferential tax treatment to purchasers and/or users of cleaner vehicles. In South Carolina, the federal credit is supplemented by 20 per cent, and there is a 20 cent per gallon biofuels credit as well.

The California Clean Energy Fund and the Massachusetts Green Energy Fund are two examples of new state-level public-private venture funds.

Many states have renewable energy incentives (Burtis, et al, 2006):

- Iowa: a 1.5 cent production tax credit (PTC) per kWh for residential and commercial renewable energy projects; sales and property tax exemptions on wind and solar energy equipment and materials; interest free loans for analysis and installation of renewable projects;
- Louisiana: Property tax exemption for the value of installed renewable energy equipment, including passive solar and solar PV;
- South Carolina: \$1,000 rebate on installation of solar water heaters;
- Idaho: low-interest loans for energy efficiency projects and for active solar, wind, geothermal, hydropower and biomass energy projects.

Colorado (and other States) also offer tax credits and rebates for renewable energy and energy efficiency. The Database of State Incentives for Renewables and Efficiency (DSIRE) is a comprehensive source of information on state, local, utility, and federal incentives that promote renewable energy and energy efficiency ([www.dsireusa.org](http://www.dsireusa.org)).

### ***Market-based Instruments***

Market-based initiatives in the US include federal and State initiatives:

#### Some federal initiatives

- Emissions trading for leaded gasoline and sulphur
- Water Quality Trading Policy
- Review of Harmful Subsidies

#### A selection of actions taken by States

- Chicago Climate Exchange
- Regional Greenhouse Gas Initiative (RGGI)
- Global Warming Solutions Act of 2006

### *Federal initiatives*

#### Emissions trading for leaded gasoline and sulphur

The United States pioneered emissions trading with trading in reductions of leaded gasoline, and of sulphur emissions. The former was part of an overall requirement to phase out leaded gasoline, with trading coming in a latter period of the process in the mid-1980s. The latter started in 1995 and is still going on, now in its second phase (which began in 2000).

See <http://www.epa.gov/airmarkets/progsregs/arp/s02.html>.

#### Water Quality Trading Policy

In 2003 the EPA announced the 'Water Quality Trading Policy' to cut industrial, municipal and agricultural discharges into the nation's waterways. The trading policy was intended to support and encourage states and tribes in developing and putting in place water quality trading programs that implement the requirements of the Clean Water and federal regulations.

#### Review of Harmful Subsidies

A single national approach to tackling environmentally harmful subsidies is difficult, as decisions are dispersed among numerous different pieces of legislation. A non-profit organisation dedicated to addressing such subsidies is Green Scissors ([www.greenscissors.org](http://www.greenscissors.org)), which has publications outlining the nature, size and effect of US subsidies.

The US government, for its part, has focused subsidy reform efforts on getting countries to reduce subsidies in areas where it feels it is put at a disadvantage, through the WTO for example, where it has tabled proposals on agriculture, fisheries and export subsidies.

### *State and Regional initiatives*

#### Chicago Climate Exchange

Although voluntary, the Chicago Climate Exchange is a US pioneer in climate emissions trading ([www.chicagoclimateex.com](http://www.chicagoclimateex.com)).

#### Regional Greenhouse Gas Initiative (RGGI)

In 2005, the governors of seven states from the Northeast and Mid-Atlantic regions (Connecticut, Delaware, Maine, New Hampshire, New Jersey, New York, and Vermont) established the Regional Greenhouse Gas Initiative (RGGI), the country's first mandatory (though not yet operational) cap-and-trade program. The goal is to reduce the region's greenhouse gas emissions by 10 percent by 2019.

Two other regional GHG initiatives have formed in the United States:

- the Western Climate Initiative ([www.westernclimateinitiative.org](http://www.westernclimateinitiative.org)), comprised of Western States;
- the Midwestern Greenhouse Gas Accord, in the Midwest (<http://www.midwesterngovernors.org/govenergynov.htm>).

#### Global Warming Solutions Act of 2006

California's Global Warming Solutions Act of 2006 (AB 32) is a major step forward in US GHG reduction commitments, putting the state at the forefront of climate policy. Among other things, it authorizes emissions trading as one means of reaching reduction objectives.

#### *Procurement*

The Energy Independence and Security Act promotes the purchase of energy efficient products (e.g. to substitute energy-efficient lighting for incandescent bulbs), and procurement of alternative fuels with lower carbon emissions, by federal government. It also requires green building standards for new federal buildings.

Section 203 of EPA Act 2005 requires that, to the extent it is economically feasible and technically practicable, the total amount of renewable electric energy consumed by the federal government during any fiscal year shall not be less than the following: 3% in FY 2007-2009; 5% in FY 2010-2012; 7.5% in FY 2013 thereafter. Section 204 requires the installation of 20,000 solar-energy systems on federal buildings by 2010.

The Federal Electronics Challenge illustrates a collaborative, industry-targeted approach to green public procurement. This is an EPA partnership programme that leverages the 65 billion USD spent annually in the US on electronic equipment and services. Under this challenge, government agencies commit to making electronic purchases that meet certain environmental criteria.

Several examples of green public procurement are given in Stack et al. (2007), though the list is by no means complete, given the myriad local, state and national institutions involved:

- US EPA use of renewable energy in its facilities in nine states;
- Iowa efficiency and renewable energy requirements for state agencies;
- Wisconsin requirements for state government buildings to meet LEED standards<sup>128</sup>;
- Washington, DC passed a law in 2006 requiring all new buildings to meet LEED standards – public buildings from 2007 and private from 2012;
- Minnesota – Environmentally Preferable Purchasing Initiative: requiring state agencies and other public entities to purchase recycled, repairable, and durable goods.

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<sup>128</sup> Leadership in Energy and Environmental Design: [www.usgbc.org](http://www.usgbc.org): 'The Leadership in Energy and Environmental Design (LEED) Green Building Rating System™ is the nationally accepted benchmark for the design, construction, and operation of high performance green buildings'

- Other governments adopting Environmentally Preferable Purchasing programs include Massachusetts; Vermont; Ohio; King County, Wash.; Austin, Tex.; and many others.
- New Mexico's Alternative Fuel Acquisition Act of 1992 requires that 75% state cars bought in 2003 and after are bi-fuel or alternative fuel vehicles, or hybrids. By 2010, all cabinet-level state agencies, K-12 public schools, and higher education institutions are required to take obtain 15% of their total transportation fuel requirements from renewable fuels
- In New York City, Local Law 6 mandates that 80 percent of new light-duty vehicles and 20 percent of new bus purchases must be powered by alternative fuels.

### *Awareness raising and training*

Awareness raising is central to the National Centre on Environmental Innovation and Performance Track. Environmental education in more general terms is also promoted through other programmes and initiatives. The Energy Independence and Security Act (2007) authorizes a media campaign to educate consumers about efficiency and conservation and to increase energy efficiency and reduce energy consumption.

### *National Centre on Environmental Innovation (NCEI)*

One of NCEI's core missions is to build capacity for innovative problem solving. One of the primary means of doing so is through the work of the Policy and Program Change Division (PPCD), which is intended to 'achieve better environmental results by scaling up pilot projects, issuing new policy directives, changing organizational culture, and rethinking traditional business practices.' Further, the Performance Incentives Division gives public recognition and further encouragement to top performing innovations.

### *Performance Track*

One of the benefits of Performance Track is provision of information resources to prospective and member companies. This is designed to help them set environmental goals, develop approaches for improving performance, learning about best practices, learning about management systems, benchmarking performance and learning about public outreach and performance reporting.

In addition, Performance Track provides participants with public exposure through a range of initiatives, including awards and public information.

### *The Clean Water Act Recognition Awards*

The program is sponsored by EPA's Office of Wastewater Management. The awards recognize municipalities and industries, including Tribal Nations and U.S. military commands for demonstrating outstanding technological achievements or an innovative process, method or device in their waste treatment and pollution abatement programs.

### *Government and non-government initiatives on environmental education*

The Green Jobs Act was voted in June 2007 to help train American workers for jobs in the renewable energy and energy-efficiency industries. It authorizes up to \$125 million in funding to establish national and state job training programs, administered by the U.S. Department of Labour, to help address job shortages that are impairing growth in green industries, such as energy efficient

buildings and construction, renewable electric power, energy efficient vehicles, and biofuels development. The Green Jobs Act would also help identify and track the new jobs and skills needed to grow the renewable energy and energy efficiency industries. Among other things, this effort would link research and development in the green industry to job standards and training curricula.

The Energy Independence and Security Act creates an Energy Efficiency and Renewable Energy Worker Training Program to train for “green collar” jobs.

Regarding environmental education generally, of which eco-innovation will play a part but is not the specific focus, there are several relevant initiatives. The US EPA’s office of environmental education has a range of programmes; substantial detail is available at <http://www.epa.gov/enviroed/index.html> . There are also partnerships with other federal agencies on a range of programmes listed on <http://www.epa.gov/enviroed/iag.html>.

In addition, there are other non-government initiatives, such as the North American Association for Environmental Education ([www.naeee.org](http://www.naeee.org) ).

### ***Acting globally***

International cooperation aims at providing partner governments with tools (not grants) which will strengthen their capacity to design and implement policies to support eco-innovation.

The National Advisory Council on Environmental Policy and Technology has recently encouraged EPA to engage more in international activities, increase awareness of and response to changing international standards and markets, and identify emerging markets for new technologies (see its [May 2007 report](#)).

A number of initiatives/institutions are relevant to stimulate and promote eco-innovation abroad. The Energy Independence and Security Act supports the promotion of U.S. energy exports in clean, efficient technologies to India and China and other developing countries; USAID is authorised to increase funding.

### ***US Agency for International Develop (USAID)***

The primary agent of US development aid, the US Agency for International Develop (USAID) has an environment programme with a range of relevant actions: [http://www.usaid.gov/our\\_work/environment/](http://www.usaid.gov/our_work/environment/). USAID is a major financier with wide-ranging impact on technology globally. Several highlights include:

- The Research programme, which focuses on agriculture.
  - USAID funds the Consultative Group on International Agricultural Research (CGIAR) at the World Bank. It sponsors 16 international research centres distributed throughout the world (13 in developing countries) which cover a wide array of basic food commodities and natural resource issues;
  - Since 1978, USAID has supported research, education, and outreach through the Collaborative Research Support Programs (CRSP). The CRSPs harness the expertise of US universities in low-cost, high-impact programs that contribute knowledge, trained personnel, and technology to agriculture worldwide in the fight against hunger and poverty;

- The Middle East Regional Cooperation (MERC) Program and the US-Israel Cooperative Development Research (CDR) Program both fund competitively reviewed, applied research projects. These research programs are open to nearly all relevant technical topics and have produced advances in saline and arid lands agriculture, enhanced understanding of emerging diseases and other threats to human health, improved water management technology, advances in biological pest management, and improved systems for natural resources and wildlife management.
- USAID’s cleaner production activities have been active for almost a decade and have worked to raise awareness, build capacity, and promote US environmental goods and services. The Agency has set a foundation of strengthening institutions and building technical and government capacity at the local and national levels. This is done through training, the development of case studies, and demonstration projects.
- USAID has funded environmental programs that have reduced growth in greenhouse gas (GHG) emissions while promoting energy efficiency, forest conservation, biodiversity, and other development goals. This “multiple benefits” approach to climate change helps developing and transition countries achieve economic development without sacrificing environmental protection

The US is also involved in a range of global technology and related agreements, some of which were initiated by the US, under leadership of the Council on Environmental Quality (the following is from [www.whitehouse.gov/ceq](http://www.whitehouse.gov/ceq) ).

#### *Asia-Pacific Partnership on Clean Development and Climate*

This US-led Partnership (including China, India, South Korea, Australia, and Japan) ‘will develop, promote, and share cleaner energy technologies to achieve results in the areas of energy efficiency, methane capture and use, rural/village energy systems, clean coal, civilian nuclear power, geothermal, liquefied natural gas, building and home construction, bioenergy, agriculture and forestry, hydropower, wind power, and solar power.’ For more information, visit <http://www.whitehouse.gov/news/releases/2006/01/20060111-8.html>.

#### *Methane to Markets*

Launched in November 2004, the Methane to Markets Partnership focuses on advancing cost-effective, near-term methane recovery and use as a clean energy source from coal beds, natural gas facilities, landfills, and agricultural waste management systems. The Partnership includes 18 countries: Argentina, Australia, Brazil, Canada, China, Colombia, Ecuador, Germany, India, Italy, Japan, Mexico, Nigeria, Republic of Korea, Russia, Ukraine, United Kingdom and United States. For more information visit <http://www.whitehouse.gov/news/releases/2004/07/20040728-2.html>.

#### *Future Gen*

In February 2003, President Bush announced that the United States would sponsor, with international and private-sector partners, the Future Gen Initiative, a \$1 billion, 10-year project to build the world’s first coal-based, zero-emissions electricity and hydrogen power plant. The Future Gen is designed to dramatically reduce air pollution and capture and store greenhouse gas emissions through carbon sequestration. For more information visit <http://www.fossil.energy.gov/programs/powersystems/futuregen/>

*Global Nuclear Energy Partnership (GNEP)*

The Global Nuclear Energy Partnership (GNEP), announced in February 2006 as part of the Advanced Energy Initiative, seeks to develop worldwide consensus on enabling expanded use of economical, zero-emission nuclear energy to meet growing electricity demand. America will work with nations that have advanced civilian nuclear energy programs, such as France, Japan, and Russia. GNEP will use new technologies that effectively and safely recycle spent nuclear fuel. For more information visit <http://www.gnep.energy.gov/>

*Renewable Energy and Energy Efficiency Partnership*

The United States participates in the Renewable Energy and Energy Efficiency Partnership (REEEP). REEEP was initiated by the United Kingdom as a WSSD partnership to assist market development of renewable and energy efficiency systems.

*International Partnership for the Hydrogen Economy (IPHE)*

Recognizing the common interest in hydrogen research, the United States called for an international hydrogen partnership in April 2003. The partnership was launched in Washington, D.C. in November 2003, with representatives from 16 governments; it provides a vehicle to organize, coordinate, and leverage multinational hydrogen research programs that advance the transition to a global hydrogen economy. IPHE will develop common recommendations for internationally-recognized standards and safety protocols to speed market penetration of hydrogen technologies.

*Carbon Sequestration Leadership Forum (CSLF)*

CSLF is a US initiative that was established formally at a ministerial meeting held in Washington, DC in June 2003. CSLF is a multilateral initiative that provides a framework for international collaboration on sequestration technologies. The Forum's main focus is assisting the development and deployment of technologies to separate, capture, transport, and store carbon dioxide safely over the long term, making carbon sequestration technologies broadly available internationally, and addressing wider issues, such as regulation and policy, relating to carbon capture and storage.

*Generation IV International Forum (GIF)*

In 2002, nine countries and Euratom joined together with the United States to charter the Generation IV International Forum (GIF), a multilateral collaboration to fulfil the objective of the Generation IV Nuclear Energy Systems Initiative. GIF's goal is to develop a fourth generation of advanced, economical, safe, and proliferation-resistant nuclear systems that can be adopted commercially no later than 2030.

*International Thermonuclear Experimental Reactor (ITER)*

In January 2003, President Bush announced that the U.S. was joining the negotiations for the construction and operation of the international fusion experiment, International Thermonuclear Experimental Reactor (ITER). ITER will allow scientists to explore the physics of burning plasma at energy densities close to that of a commercial power plant, the critical next step in producing and delivering commercially available electricity from fusion to the grid.

### *Clean Energy Initiative (CEI)*

At the World Summit on Sustainable Development (WSSD) in Johannesburg in 2002, the United States launched a Clean Energy Initiative (CEI). CEI consists of four market-oriented, performance-based partnerships: Global Village Energy Partnership, led by the U.S. Agency for International Development; Partnership for Clean Indoor Air and Partnership for Clean Fuels and Vehicles, led by EPA; and Efficient Energy for Sustainable Development, led by DOE. The mission of CEI is to bring together governments, international organizations, industry and civil society in partnerships to alleviate poverty and spur economic growth in the developing world by expanding access to and modernizing energy services.

### *US-Brazil agreement on ethanol*

President Bush and Brazilian President Luiz Inacio Lula da Silva recently signed an agreement regarding ethanol that will promote technology exchange between the countries and work to develop international biofuels standards.

### *California-Sweden agreement on biogas*

The California Energy Commission and Sweden's Ministry of the Environment signed a joint development agreement for biogas and other alternative fuels. The agreement will promote the exchange of ideas and technologies between the two, enabling California to learn from Sweden's biogas experience (the country has the largest biogas vehicle fleet in the world), while providing Sweden with an opportunity to market its products in California markets.

### *Supporting exports of eco-industries*

Two major initiatives support exports in clean technologies.

The Clean Energy Technology Export (CETE) program is intended to be a public-private partnership that addresses export barriers in global markets. The program does not deal with technology development, but with proven technologies. CETE's activities fall into 3 categories:

- *Outreach.* This effort consists mainly on information sharing and coordination among agencies. One recent example is the launching of a specialized website in March 2007 to "assist US companies in the deployment of clean energy technology in global markets."
- *Tools.* These are programs that are intended to help multiple vendors with multiple projects, and address issues that no one company working alone could resolve.
- *Partnerships.* These efforts serve to strengthen both efforts mentioned above—outreach and tools. The purpose is to institutionalise contacts and foster regular collaboration with the private sector, rather than encourage such arrangements on an *ad hoc* basis. One example of such partnership is the efforts by CETE to promote fora for venture capitalist and new technology companies where they can explore opportunities to create mutual benefits.

A brief example about Guatemala illustrates how the CETE programs work in practice.

The Ex-Im Bank established the Environmental Exports Programme in 1994, to increase support to environmentally beneficial goods and services exports. The programme helps mitigate risks for US environmental companies and also offers competitive financing terms to international buyers for the

purchase of US environmental goods and services. The programme covers renewable energy equipment, wastewater treatment projects, air pollution technologies, waste management services, inter alia.

### **Box 2. Clean Energy Technology Export in Guatemala**

Because Guatemala presents ideal conditions for the development of small and medium hydro-power plants, some US producers have explored investment possibilities in that market.

To explore the opportunities for US companies, a consultant with local market knowledge is hired to help potential exporters identify the main opportunities for contracts as well as the main barriers to the construction and operation of the hydro-power plants. The expert is hired by the industry with some support from the DoE.

In the case of Guatemala, a critical barrier for the deployment of technologies, according to the US expert, are the off-take practices in place: the country provides “spot” (or present) prices but offers no long-term off-take prices to the provider of clean technology. This uncertainty about future demand and price spills over the company’s financing strategy because the technology providers are unable to guarantee to the investors that electricity will be purchased at a profitable price in the future.

CETE intervenes by establishing a relationship with the Guatemalan government to, inter alia, explore possibilities that guarantee predictable off-take prices in the future. In practice, the governmental decision to intervene or to leave the deployment to market forces is a difficult task.

### ***Other instruments to support eco-innovation***

#### **Small Business Innovation and Research Program**

SBIR funds technology development through competitive solicitations for small businesses (less than 500 staff) in the initial stages of the technology continuum (before venture capital becomes interested). SBIR focuses on proof of concept (Phase I) and commercial prototype (Phase II). It is a cooperative effort of 11 agencies. The total budget for the program was more than USD 2 billion 2005.

Since the early 1980s, USEPA has been supporting small business innovators in the development of technologies, products and processes that are helping the Agency to achieve its strategic long term goals. Since its inception, USEPA’s SBIR programme has provided some 100 million USD through more than 700 awards to small businesses to translate their ideas into commercial products. Success is monitored technologically (through awards, patents, etc.) and commercially (sales, commercial partnerships, follow-on funding, etc.).

The money is allocated to technology developers through grants. Options are available to share the cost of technology verification and of commercialisation (if a third party is cofounding). Staff from an EPA lab serves as an informal mentor for the vendor.

It is noteworthy that focus is shifting more towards commercialisation and a request to proven environmental benefit.

#### **California Global Warming Solutions Act**

While the United States have been reluctant to enact national level climate change policies which may have ‘market pull’ impact on technology innovation (e.g. a mandatory cap or similar), States are becoming quite vocal in this regard. These policies will stimulate innovation through market pull; the

California Global Warming Solutions Act of 2006 (AB32) is the first mandatory statewide greenhouse gas reduction legislation with non-compliance penalties.

#### EPA's Superfund Innovative Technology Evaluation

SITE is a demonstration programme that offers a mechanism for conducting joint technology demonstration and evaluation projects at hazardous waste sites involving the private sector, EPA, and other state or federal agencies. All participants (SITE programme, site owner, technology vendor) share in the project funding through financial and in-kind contribution (see <http://www.epa.gov/NCEI/directory/index.htm>). SITE illustrates a problem-solving approach, where EPA joins with other players to support the demonstration of innovative technologies.

### **Country Synthesis**

#### *A genuine focus on innovation*

Innovation is explicitly conceived by the United States as the primary response to the contemporary environmental challenges, including climate change and energy security. In this perspective innovation includes, but is not restricted to, technology.

Innovation applies to regulatory practices as well. It is consequential for the way agencies work together and engage nongovernmental actors. It follows that eco-innovation policies are not top-down: they are very much interlocked. Having an open-ended approach to innovation has fostered multiple forms of collaboration within and across agencies, with industry, academia, non-profit organisations and states.

The focus on technology is shifting. R&D still attracts a lot of attention and public money, in particular in the energy sector: at DoE, renewable energy, alternative fuels, and cleaner coal are receiving increased research attention and funding. There is a clear orientation towards problem solving. In a pragmatic approach, innovation may come from a variety of sources (including foreign suppliers). Technological innovation is acknowledged as a collaborative process and a number of initiatives stress that labs should cooperate with the private sector and pay attention to the dissemination/commercialisation of their work. One feature of the US experience is the dynamism of venture capital and the flexibility of instruments designed to harness private capital and to incentivise public entities (in particular laboratories).

#### *Collaborative action*

The US innovation system is uniquely decentralized leading to flexible approaches and a competitive spirit. Several federal agencies and departments manage their own programmes to spur environmental technology innovation. Most federal activities accrue from the Environmental Protection Agency (EPA), the Department of Agriculture (USDA) and the Department of Energy (DOE).

EPA explicitly links innovation and collaboration: leveraging limited resources and sharing expertise are considered key factors of success, in the context of complex challenges and tightening federal budget.

Collaboration is organised at federal level, among agencies. It also involves a number of local and nongovernmental players, including States, venture capital, the private sector and nongovernmental organisations (which play an important role in stimulating policy debates).

States play a particular part, as they take a number of initiatives with or without federal support (half of EPA's budget is granted to States). They have a (limited) capacity to directly finance R&D. Important measures, increasingly in use at local and state level, have to do with performance standards such as requirements for green buildings, or portfolio standards for renewable energy.

Venture capital is also key, when it comes to financing innovation and its deployment. Collaboration with industry is organised at the level of the firm (e.g. the Climate Leaders) or at industry level (with sectors that are committed to reducing emissions, e.g. Smartway Transportation Partnership with the ground freight transportation industry).

Institutions have been set up to facilitate collaboration between federal agencies and other players (see Box 3).

### **Box 3. Institutionalised collaboration**

#### **The Biomass R&D Board in the US**

The Board is an inter-agency initiative that grew from a mandate in the 2005 Energy Policy Act (<http://www.biofuelspostureplan.govtools.us>). It is co-chaired by US Department of Agriculture and the Department of Energy. A number of federal agencies sit on the Board: transportation, the national Science Foundation, the White House Office of Science and technology, Department of Commerce, Department of Energy, NOAA, USEPA, National Institute of Standards and Technology (NIST).

The Board promotes a systemic approach because of the interdependencies of a number of dimensions (feedstock, feedstock management, conversion, infrastructures, and end use). In particular, the Board is concerned with issues related to logistics and economics (the Energy Independence and Security Act includes provisions to improve the infrastructure for delivering renewable fuels).

The strategy entails a number of instruments, from direct public funding of specific technologies, to economic incentives (tax credit), regulation (such as the Energy Policy Act in 2005), permitting (it becomes an issue when refineries mushroom all over the country).

Each agency plays a particular part, based on its own expertise and agenda. Typically, the Department of Energy is putting a lot of public R&D on refineries (including biochemical processes). EPA is promoting waste as a source of energy, an item that was not initially considered by the Board.

The Strategy has an international dimension: Canadian companies are involved, as well as European ones which supply technologies that correspond to specific needs.

#### **Climate Change Technology Program (CCTP)**

The Climate Change Technology Program (CCTP) is a multi-agency effort that increases the development and use of key technologies aimed at reducing GHG emissions. The intent of this program is to reduce, avoid, or sequester greenhouse gas emissions by stimulating the development and use of renewable, clean coal, fusion, nuclear and other energy technologies and by increasing energy efficiency throughout the U.S. economy.

#### *Public funding for R&D*

Public funding accrues to environmental R&D, either via direct financial support or via the increasing use of tax credits to help finance innovative technologies.

Together with Japan, the United States offer among the strongest public support for energy R&D. For example, the combined funding of US and Japanese governments is around 70% of the total

energy R&D expenditure of all IEA member countries reaching USD 6.8 billion in 2004. Measured as percentage of GDP, energy R&D investments in the United States ranks fifth among IEA members while Japan ranks first (OECD, 2006b).

The US government also provides major support for R&D in renewable energy. According to 2002 data from the IEA, the United States allocated a peak of USD 700 million for solar energy, and approximately US\$1 billion for all renewable energies in the early 1980s. Since then funding for solar energy has stabilised at approximately US\$ 100 million per year for the past 20 years.

The DoE is a major provider of funding for basic and applied research for converting biomass resources to biofuels<sup>129</sup>; it finances research, development, and demonstration efforts geared at the development of integrated biorefineries; the Biomass Program is focusing its R&D efforts to ensure that cellulosic ethanol is cost competitive by 2012; US\$ 198 million are appropriated for the Biomass Program in the FY 2008 budget (see <http://www1.eere.energy.gov/biomass/budget.html>). In addition, DoE conducts joint solicitations with the U.S. Department of Agriculture (USDA) as part of the Biomass Research and Development Initiative.

Wind and geothermal energy R&D is supported at a level of approximately USD40 million each year. A 20% tax credit is also available for “incremental” R&D for private companies. Some joint public-private cost sharing programs exist as well ([www.doe.gov](http://www.doe.gov)).

The estimated budget authority for renewable energy programs was nearly US\$ 349 million in 2003 (these programs mostly address R&D). Two income tax preferences, a new technology credit, and exclusion of interest on facility bonds supported renewable energy at an estimated outlay of around US\$ 510 million in 2003 (General Accounting Office, 2005).

*More support to commercialise R&D outcomes*

The National Advisory Council on Environmental Policy and Technology has recently reviewed EPA’s role in impacting market demand forces to empower technology development, both within the US and abroad (see its May 2007 report). NACEPT recommends that, to encourage market demand, USEPA:

- Includes emission credit trading as a component of environmental programs wherever possible; it can stimulate the weak market for many new technologies;
- Allows greater flexibility in permitting at state level, to promote progressive technology development;
- Makes sure enforcement actions authorize the development, piloting, or enhancement of environmental technology where appropriate;
- Provides the environmental marketplace with independent information and quality assured data on the performance of innovative, commercial-ready technologies;
- Expands on the success of the voluntary ENERGY STAR program, creating additional “green” standards for a wide variety of industries and activities;

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<sup>129</sup> It is noteworthy that efforts in bioenergy were initiated by the National Science Foundation (NSF) and subsequently transferred to DOE in the late 1970s

- Expands and stimulates environmentally preferential purchasing.

*The challenge of an international approach*

It is fair to say that most initiatives are usually open to US technology suppliers only. However, some programmes are increasingly oriented towards problem solving and hence open to inputs from foreign suppliers.

In addition, a variety of initiatives, in the energy and in other fields, attempts to engage foreign governments and international institutions.

Developing countries are the targets of USAID programmes which strive to spread the benefits of US innovations.

**Appendices**

**Summary table**

<b>R&amp;D</b>	
US EPA Office of Research and Development:	Various EPA programmes to support technology
US DOE: national laboratories	DOE administers the laboratory system
State R&D initiatives	Technology incubators One example is the city of Austin's clean energy incubator State R&D investment funds Connecticut Clean Energy Fund California Public Interest Energy Research Program
Council on Environmental Quality	Technology Platforms Climate Change Technology Platform SmartWay transportation partnership Hydrogen Fuel Initiative
<b>Verification of Technologies</b>	
US EPA	Environmental Technology Verification (ETV) program
<b>Performance Targets</b>	
National Regulations	Not considered in detail here, reference to major regulations such as the Energy Independence and Security Act, the Clean Air Act and Clean Water Act, the Green Jobs Act, Corporate Average Fuel Economy regulations
US EPA	National Performance Track
EPACT	Federal Renewable Fuels Standard Extension of minimum standards of energy efficiency of major appliances
Voluntary standards	EnergyStar Natural Gas Star
Energy performance in federal facilities	Energy Policy Act of 2005 Executive Order 13423
California standards	GHG emissions performance standard act Low Carbon Fuel Standard
RPS in various states	California, Illinois, Nevada, New Jersey, New Mexico, New York, Pennsylvania, Rhode Island, Texas.
Efficiency Standards on household appliances	Arizona, California, Connecticut, Maryland, New Jersey and New York
<b>Financing</b>	
EPACT	The Energy Policy Act of 2005 Renewable Energy Production Tax Credit
Biofuels	Volumetric Ethanol Excise Tax Credit
State and local level programs	California's Public Interest Energy Research (PIER) New York State Energy Research and Development Authority (NYSERDA). California Solar Initiative Green Wave initiative Colorado tax on fossil fuel power for electricity Many states' preferential tax treatment for greener vehicles California Clean Energy Fund Massachusetts Green Energy Fund State level renewable energy incentives: Iowa, Louisiana, South Carolina, Idaho

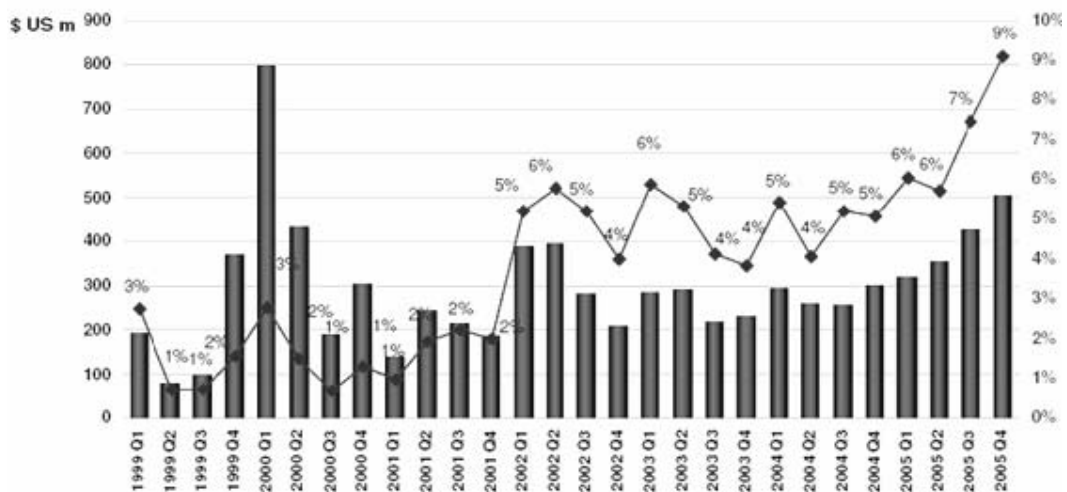
<b>Market Based Instruments</b>	
Trading Policies - federal	Emissions trading for leaded gasoline (no longer functioning) Emission trading for sulphur Water Quality Trading Policy'
Subsidies	Www.greencissors.org: critical assessment US government involvement in WTO
Emissions Trading – state/regional	RECLAIM (no longer functioning) Illinois VOC trading Chicago Climate Exchange RGGI California's Global Warming Solutions Act of 2006 Western Climate Initiative (incl. California – not a national-only initiative hence not mentioned here)
<b>Procurement</b>	
State programmes	Several initiatives noted: environmentally responsible purchasing programmes, efficiency and renewable energy requirements, vehicle and fuel standards.
EPACT	Federal Agency energy consumption decrease targets Increasing renewable energy on federal facilities, and a specific target for solar energy.
<b>Awareness raising and training</b>	
Specific for eco-innovation	National Centre on Environmental Innovation (NCEI) Performance Track (see also ' <i>Performance Targets</i> ')
Environmental Education	US EPA Office of environmental Education: many programmes North American Association for Environmental Education
<b>Acting Globally</b>	
State Department - Bureau of Oceans, Environment, and Science (OES)	Coordinates international policy and diplomacy on environment and science
USAID	Its environment programme gives aid in many relevant programmes internationally
Technology agreements	Asia-Pacific Partnership Methane to Markets Future Gen Global Nuclear Energy Partnership Renewable Energy and Energy Efficiency Partnership G8 International Partnership for the Hydrogen Economy (IPHE) Carbon Sequestration Leadership Forum Generation IV International Forum International Thermonuclear Experimental Reactor Clean Energy Initiative Ethanol agreement with Brazil
State programmes	California biogas agreement with Sweden
<b>Other instruments</b>	
Global warming caps	California's AB32 legislation

**Green technologies in the US**

As the world’s largest economy, the United States plays a leading role in many industries and eco-industries are no exception. The ‘environment industry’ has grown from less than \$20 billion in 1970 to \$245 billion in 2004, and is responsible for 2.1% of GNP and employ 1.3 million people in the United States (Andersson and Widegren, 2006). Importantly, the share of innovation funding dedicated to eco-industries is rising.

**Figure 8. Venture capital funding eco-innovation**

The amount of venture capital investment in clean technologies in amounts (left) and as a percentage of VC investment (right)



Source : Andersson and Widegren, 2006

Clean Technology (cleantech) has moved from the 7th largest venture investment category in 2004, to 5<sup>th</sup> in the last quarter of 2005 – surpassing semiconductors. Venture capital investment in cleantech reached \$1.4 billion in 2005, with around 70% of this going to energy (Andersson and Widegren, 2006).

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