



International  
Energy Agency

*Developed in co-operation with the G-20 Clean Energy  
and Energy Efficiency Working Group*

# **G-20 CLEAN ENERGY, AND ENERGY EFFICIENCY DEPLOYMENT AND POLICY PROGRESS**

**2011**



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The IEA would like to thank the Organisation of the Petroleum Exporting Countries (OPEC), the International Renewable Energy Agency (IRENA), and all participants in the G-20 C3E Working Group for their constructive review and comment of the earlier drafts of this report.

*This information paper was prepared for the G-20 Clean Energy and Energy Efficiency Working Group (C3E) in October 2011. It was drafted by IEA's Energy Technology Policy Division in co-operation with other Divisions of the IEA. This paper reflects the views of the International Energy Agency (IEA) Secretariat, but does not necessarily reflect those of individual IEA member countries. For further information, please contact Antonia Gawel at: [antonia.gawel@iea.org](mailto:antonia.gawel@iea.org)*

## INTERNATIONAL ENERGY AGENCY

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

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

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**International Energy Agency**  
9 rue de la Fédération  
75739 Paris Cedex 15, France

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## Background

In their June 2010 Communiqué, G-20 leaders stressed that their overriding objective is to “safeguard and strengthen the (global economic) recovery and lay the foundation for strong, sustainable and balanced growth ...” (G-20, 2010a). In line with achieving this objective, their November 2010 Seoul G-20 Communiqué committed to “support country-led green growth policies that promote environmentally sustainable global growth along with employment creation while ensuring energy access for the poor. (They) recognise that sustainable green growth, as it is inherently a part of sustainable development, is a strategy of quality development, enabling countries to leapfrog old technologies in many sectors, including through the use of energy efficiency and clean technology.” Countries agreed to “take steps to create, as appropriate, the enabling environments that are conducive to the development and deployment of energy efficiency and clean energy technologies, including policies and practices in (their) countries and beyond, including technical transfer and capacity building.”

While supporting the ongoing initiatives of the Clean Energy Ministerial, the Energy Experts Group was requested “to monitor and report back (...) on progress at the 2011 Summit in France” (G-20, 2010b).

In support of this request, the International Energy Agency (IEA) has worked in collaboration with the Clean Energy and Energy Efficiency (C3E) Working Group, with input from other international organisations to develop this report, which highlights G-20 country and C3E member progress in clean energy and energy efficiency technology deployment and policy development.

While many energy efficiency and clean technologies will be required to enable environmentally sustainable global growth, this report focuses only on progress in those technologies highlighted within the C3E questionnaire (see Annex I), which include energy efficiency, renewable power, nuclear power, renewable heat, carbon capture and storage (CCS) and transport.

## Scope and methodology

Upon request of the C3E, this draft report provides an overview of current clean energy technology deployment, and summarises policies in place to accelerate the uptake of these technologies across G-20 and C3E member countries.

This report is intended to inform the discussions of the C3E and does not include recommendations for action. Following the guidelines of the C3E, the Report policy content is drawn predominantly from the Working Group country submissions. The report summarise contents from these submissions that were comparable, and for which information was submitted by a sufficient number of countries. The short timeframe available to review country submissions and complete this draft report only allowed for brief interaction with countries to clarify contents. While not all details of the individual submissions are included in the report policy tables, these are contained in the document *Compendium of G-20 C3E Working Group Questionnaire Submissions*.

As the IEA has aimed to provide as complete policy information as possible, some policy details have been supplemented where incomplete with information from the IEA Policies and Measures Database (<http://www.iea.org/textbase/pm/index.html>). For countries that did not submit the C3E questionnaire, information already available to the IEA has been included in the report. Some historical technology deployment data has also been included throughout the report to provide the readers with basic, but necessary context about the status of the various technologies being discussed.

The term 'G-20 countries' used throughout the report, includes the following countries: Argentina, Australia, Brazil, Canada, China, European Union, France (G-20 Presidency), Germany, India, Indonesia, Italy (C3E WG Co-Chair), Japan, Republic of Korea (C3E WG Co-Chair), Mexico, Russia, Saudi Arabia, South Africa, Spain (C3E WG Co-Chair), Turkey, United Arab Emirates (G-20 Observer), United Kingdom, and United States. These countries are all members of the G-20 C3E Working Group.



## Acknowledgements

This report relies heavily on the policy information submitted by member countries of the G-20 C3E working group. We would therefore first like to thank all those officials from G-20 countries who contributed long hours to this effort, without which this report would not have been possible. We would also like to thank the Organisation of the Petroleum Exporting Countries (OPEC), the International Renewable Energy Agency (IRENA), and all participants in the C3E working group for their constructive review and comment of the earlier drafts of this report. While this final report was not able to take all views into account, it has aimed to present a balanced reflection of the inputs received. This report would also not have been possible without the strong support of the C3E working group and its co-chairs: Italy, Spain, and the Republic of Korea.

The production of this report was co-ordinated and co-authored by Antonia Gawel, with significant section information analysis and drafting from the following colleagues: Adam Brown, Zuzana Dobrotkova and Ada Marmion on renewable power and heat; Anselm Eisentraut on biofuels; Robert Tromp and Charlotte Forbes on energy efficiency; François Cuenot, Lew Fulton and Tali Trigg on transport; Sean McCoy and Justine Garrett on Carbon Capture and Storage; and Kevin Breen on nuclear energy and other report aspects.

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## Introduction and summary of findings

The deployment of clean energy technologies around the world is progressing rapidly: implementation of energy efficiency policies is improving, renewable energy technologies have seen 27% to 56% growth rates in recent years<sup>1</sup>, and governments are beginning to set goals to support the development of advanced vehicle markets. Table 1 provides a brief overview of deployment levels and growth rates in a number of clean energy technologies:

**Table 1** Annual growth rates 2000-10 and 2010 status of deployment for clean energy technologies

Technology	Growth rate	2010 status of deployment
Biofuels	24%	104 billion litres
Biomass power	8%	284 TWh
Hydro power	3%	3 428 TWh
Solar PV	56%	34 TWh
CSP	29%	2 TWh
Wind	27%	338 TWh
Geothermal power	4%	72 TWh
Nuclear power	0%	2 630 TWh
Solar thermal heat	11%	172 GWth
Carbon Capture and Storage	-	8 large scale projects in operation*
Electric vehicles	-	-

\* According to GCCSI database assessment, 2011.

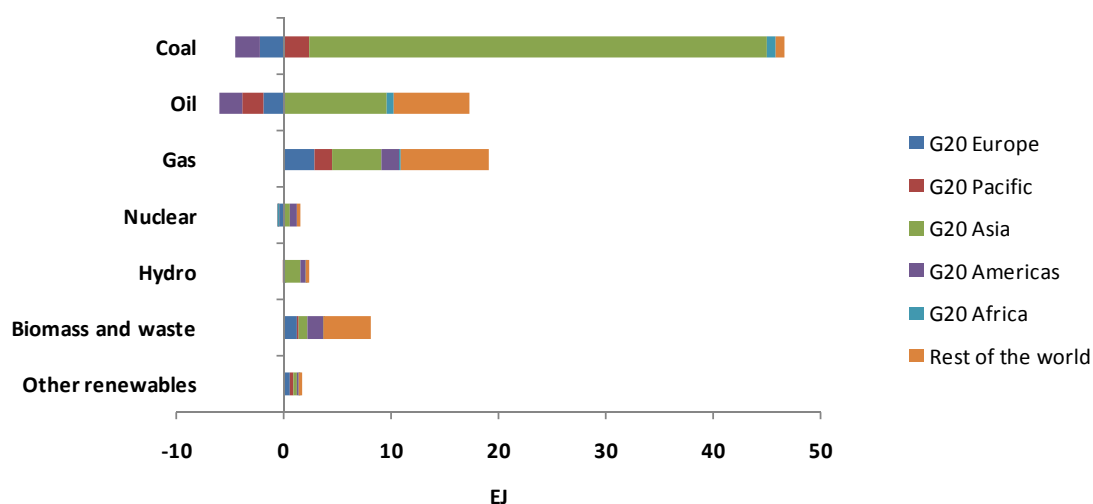
Note: All growth rates are calculated as average annual growth rates from 2005 to 2010 with the exception of solar thermal heat which is calculated from 2005-09. Renewable generation for 2010 is estimated data. Solar thermal status is presented for 2009.

Source: IEA Statistics

While this progress has been positive, the world is still largely dependent on fossil fuels to satisfy growth in global energy demand (Figure 1). In the past decade, coal has met nearly 50% of new electricity demand globally and oil currently accounts 94% of energy supply in the transport sector. While renewables growth has been positive, non-hydropower renewables represented only 3% of final electricity production in 2009. Improving end-use efficiency, enhancing the efficiency of fossil fuel based power generation, and supporting the widespread deployment of CCS will, therefore, also be crucial aspects of the transition to a cleaner energy future.

<sup>1</sup> From 2005 to 2010, wind power grew and an average rate of 27% per year, and solar photovoltaic at an average rate of 56%.

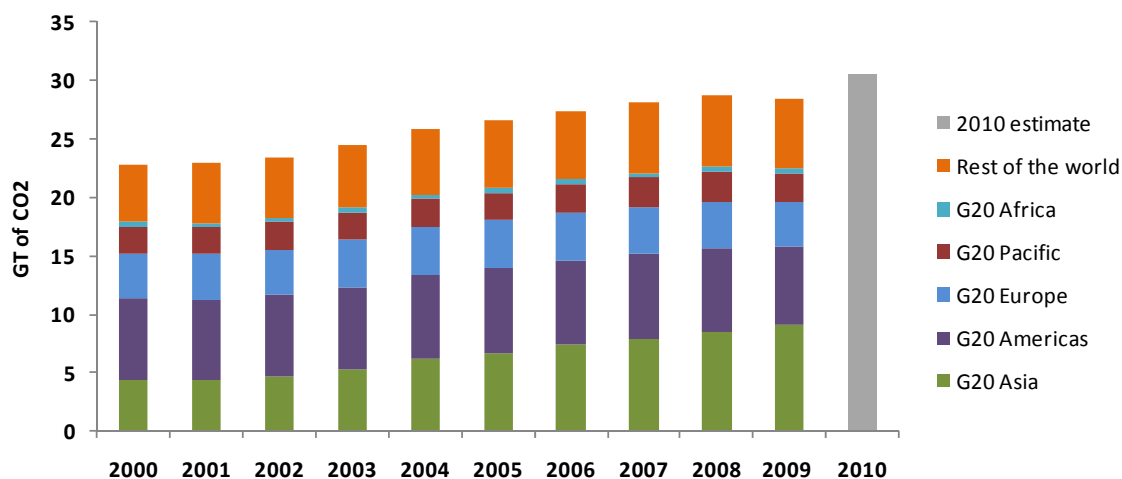
**Figure 1** Incremental total primary energy supply in G-20 and the world 2000-09



Note: G-20 Europe including Russia is France, Germany, Italy, Russia, Spain, Turkey, United Kingdom. G-20 Pacific is Australia, Indonesia, Japan and Korea. G-20 Asia is China, India and Saudi Arabia. G-20 Americas is Argentina, Brazil, Canada, Mexico and the United States. G-20 Africa is South Africa. All data is official IEA statistics.

The consequences of this trend are starker than ever. Energy related CO<sub>2</sub> emissions over the past decade have steadily increased (Figure 2). Despite the slight drop observed in 2009 due to reduced economic demand, early 2010 CO<sub>2</sub> emissions estimates suggest that they were at an historic high of 30.6 Gigatonnes (Gt). This represents a 5% jump from the previous high in 2008. Perhaps, more important is that 80% of projected emissions from the power sector in 2020 are locked in due to infrastructure investments already made.

**Figure 2** Global energy related CO<sub>2</sub> emissions for G-20 and the world 2000-09



Note: All data is IEA statistics. 2010 data are estimates.

The G-20 group of countries represents close to 80% of these energy related CO<sub>2</sub> emissions, although individual countries show a wide range of current, historical, and per-capita emissions levels (per capita emissions ranged from 1.4 to 17.7 tonnes CO<sub>2</sub> in 2009). The G-20 group is therefore presented with an important opportunity to make collective progress towards the objective of developing and deploying energy efficiency and clean energy technologies.

# Clean energy technology deployment and policies in G-20 countries

The transition towards a cleaner energy future will require the development and deployment of array of technologies across the entire energy sector (IEA, 2010). This section provides an overview of energy efficiency and clean energy technology deployment and policy progress in G-20 countries, with a focus on those technologies included in the C3E Working Group questionnaire. This includes energy efficiency in buildings, lighting, appliances and industry; renewable power; nuclear power; renewable heating and cooling; carbon capture and storage, and transport.

## Energy efficiency

Energy efficiency is a crucial resource that can help meet future energy needs in all countries. Its benefits have the potential to be far-reaching, by offsetting increases in final energy demand, providing savings on energy bills, and enabling CO<sub>2</sub> emission reductions. The recent IEA study *Saving Electricity in a Hurry* also observed that implementation of energy efficiency measures is also critically important to avoid prolonged electricity shortfalls, which are caused when demand outpaces electricity available to customers. Prolonged electricity shortfalls can reduce economic competitiveness by creating uncertainty in electricity supply and increasing electricity costs (IEA, 2011a).

Government policies in energy efficiency tend to focus in seven different areas: cross-sectoral activity, buildings, appliances, lighting, transport, industry and power utilities. As all sectors differ, effective policy packages should reflect the diffuse and incremental nature of energy efficiency actions. Policies also need to include a systemic approach, as no policy can be implemented in isolation.

The encouraging news is that public policy has already made substantial strides in successfully transforming markets for an array of energy-efficient products, including compact fluorescent light bulbs (CFLs), refrigerators, motors and key building components. These successes have been delivered by a suite of well-designed and implemented energy-efficiency policies, such as building codes, standards and labelling (S&L), energy certification schemes and utility programmes.

However, pervasive barriers to energy efficiency investment and implementation of related policy measures remain: these include information, transaction, financing, institutional and structural barriers, and regulatory issues that can slow down investment. As energy efficiency is diverse, addressing these barriers can be complex. Further efforts are needed to advance integrated building design and performance, strengthen appliance standards across the board, improve monitoring and verification of labelling and certification schemes, incentivise utilities to invest more in energy efficiency and provide a competitive framework for industry to invest in the Best Available Technology (BAT).

The following section provides an overview of G-20 country technology deployment and policy progress in the areas of energy efficiency in buildings, lighting, appliances and industry.

## Energy efficient buildings, lighting and appliances

The energy consumption of the buildings sector is projected to grow from 2 759 Mtoe in 2007 to 4 407 Mtoe by 2050, with over half this consumption in residential buildings. Deep cuts in the energy consumption of the building sector can however be attained in a cost-effective way by implementing stringent requirements for both new and existing buildings and deploying currently existing energy-efficient technologies on a global scale.

Significant barriers to achieving the potential energy efficiency savings in buildings must, however, be addressed. These include split incentives between tenant and landlords, lack of awareness of efficient technologies, absence of qualified technicians and high initial investment costs. Ways to help overcome these *barriers* include ensuring that all new buildings, as well as buildings undergoing renovation, are covered by energy codes and meet minimum energy performance requirements. This should be done in a way that does not impact the provision of affordable living to low-income households.

### Summary of G-20 policies

Policies to improve the energy efficiency of existing buildings, with emphasis on significant improvements to building envelopes and systems during renovations will help achieve energy efficiency objectives. In order to improve the **energy efficiency of buildings** specifically, an array of policy instruments are available. These include regulatory building codes, voluntary approaches, economic instruments, energy certification schemes, and minimum energy performance standards (MEPS) or S&L for building components, as outlined in Table 2 below.

**Table 2** Building energy efficiency policy types

Policy instrument	Description
<b>Regulatory building codes</b>	These include energy efficiency standards for new buildings; the stringency of building codes standards should be reviewed and advanced.
<b>Voluntary approaches</b>	These are a useful preliminary step for countries beginning to develop energy efficiency policies, in order to prepare for the development and implementation of mandatory building standards. Currently, there is not significant information about this approach in G-20 countries.
<b>Economic instruments</b>	These include grants and tax reduction. They are important across G-20 countries to increase leverage in energy efficiency investments in buildings. The United State's Weatherisation Assistance Program provides grants for energy efficiency retrofits. Over the past 33 years, they have serviced more than 6.4 million low-income households and reduced annual energy bills on average by about USD 437 after weatherisation has taken place. In France, Italy and the United Kingdom, tax incentives are a commonly used economic instrument whereas Germany supports a preferential rate loan system for the energy-efficient renovation of buildings. Governmental subsidies and tax incentives for Energy Efficiency technologies are provided in Russia under recently adopted Federal program and Energy efficiency legislation.
<b>Energy certification schemes</b>	These aim to make sure buyers and renters of buildings are adequately informed of the building's energy efficiency. Eight countries have implemented mandatory certification schemes for buildings. On top of the mandatory certification scheme, voluntary certification schemes exist and have been implemented with success: examples include Leadership in energy and Environmental Design – LEED (United States), Building Research Establishment Environmental Assessment Method – BREAM (United Kingdom), and Haute Qualité Environnementale –HQE (France). Training of qualified experts on the energy certification procedure and informing citizens about energy certification is also fundamental. In Spain, the Institute for Diversification and Energy Saving (IDAE) has carried out several campaigns, developed guides and carried out training courses, in collaboration with the Autonomous Communities.
<b>Minimum energy performance requirements and Labels (MEPS or S&amp;L) for buildings' components</b>	Voluntary labelling schemes and minimum energy performance energy requirements are usually implemented for windows. The scope of the revised European Union EcoDesign Directive (2009/125/EC) has been extended to include energy-related products. In the near future mandatory S&L requirements for windows are expected to be adopted within the EU.

**Household appliances** represent the best example of how government policies and public-private partnerships can transform consumer purchasing of energy-consuming equipment. Government led MEPS and labelling programmes are used widely in this sector and have been transformative, leading to increased functionality and efficiency of most appliances while reducing unit costs. Product energy labelling takes one of two forms: endorsement labelling, such as the United States Energy Star label (generally of voluntary nature), and comparative labelling, also used widely across G-20 countries (usually in the form of mandatory programmes). Mexico uses a voluntary *FIDE Label* system to certify and identify energy efficient products for the Mexican market. India established its

mandatory energy efficiency labelling programme in 2007 covering many appliances including air conditioners, televisions, and refrigerators. Although end-use MEPS and labelling programmes in equipment and buildings are being implemented with increasing frequency, the extent of compliance varies.

**Lighting** on its own consumes a fifth of global electricity. Globally, incandescent lamps are estimated to have accounted for 970 TWh of final electricity consumption in 2005 (IEA 2006). In the hypothetical case that all these lamps were to be replaced by CFLs, cumulatively this would reduce global net lighting costs by USD 1.3 trillion from 2008 to 2030 and avoid 6.4 Gt CO<sub>2</sub> emissions at negative abatement cost. The phasing out of inefficient lamps is, therefore, a key priority in this area.

To overcome the high purchase cost which held back the market penetration of CFLs initially, most countries introduced the phase-out of incandescent light bulbs which began in 2010. Japan for example, implemented MEPS for the most inefficient bulbs and progressed to a removal from the market of all incandescent lamps. Australia, Brazil, Russia, Canada and Korea have announced or introduced policies that will lead to the phase-out incandescent lamps, while China and India are considering such policies.

Table 3 provides an overview of energy-efficiency targets, policies and their progress, with a focus on the building sector and inclusion of some measures related to lighting, and household appliances. Complete country submissions with further details can be found in the document *Compendium of G-20 C3E Working Group Questionnaire Submissions*.

**Table 3** Summary of G-20 country building, lighting and appliance efficiency policies

Country	Summary of Policies/Targets	Policy type	Progress/Status
Argentina	A variety of labelling rules, provisions and resolution on appliances, air conditioners and electric appliances for washing, drying clothes and lighting.	Labelling, voluntary and compulsory schemes and minimum standards.	Implementation underway in some areas. Plan to implement in other areas.
	Tax Breaks for Green Buildings Program allows eligible businesses that invest in improving the energy efficiency of their existing buildings will be able to apply for a tax break.	Financial incentives	Implemented
Australia	Under the Building Energy Efficiency Disclosure Act 2010 there are mandatory obligations applicable to many commercial buildings. Most sellers or lessors of office space of 2,000 square metres or more will be required to obtain and disclose an up-to-date energy efficiency rating.	Regulatory	Implemented
	Energy Efficiency in Government Operations (EEGO) aims to reduce the energy consumption of Australian Government operations with particular emphasis on building energy efficiency.	Scheme	Government office buildings are to achieve the following energy intensity targets by June 2011: 7,500 MJ/person per annum for tenant light and power; 400 MJ/m <sup>2</sup> annum for central services.
	Clean Technology Food and Foundries Investment Program will provide grants to food and beverage processing and metal foundries and forging industry firms to invest in energy-efficient capital equipment and low-pollution technologies and processes.	Financial incentives	Development underway
	The Equipment Energy Efficiency (E3) Program applies Minimum Energy Performance Standards (MEPS) and Energy Rating Labels (ERLs) to appliances, equipment and lighting products. Phase-out of inefficient lighting commenced in 2009 with the removal of 'A' shaped GLS incandescent lamps of all wattages from the market.	Standards	22 products are covered by the program with a further 20 being proposed for future consideration.

<b>Brazil</b>	Labelling Programme for residential, commercial and public buildings;	Education & outreach (labelling)	Implementation underway
	Labelling Programme, Energy Efficiency Seal and Minimum Energy Performance Standards, acting complementarily.	Regulatory (MEPs for Appliance )	Fully Implemented
<b>Canada</b>	ecoENERGY for Buildings and Houses	Education & outreach (Dollars to Sense workshops, training programmes, rating & labelling); model codes; partnerships & capacity building.	Substantial implementation
	ecoENERGY Retrofit Initiative	Financial Incentives for energy efficiency improvements in homes & grants of up to USD 5 000 per unit for home and property owners.	Substantial implementation
<b>European Union</b>	Energy Efficiency Plan	Regulatory instruments (binding measures, obligations for entities, etc)	Implementation underway, however: recent Commission estimates suggest that the EU is on course to achieve only half of the 20% energy saving objective. The Commission has, therefore, developed a comprehensive new Energy Efficiency Plan.
	Intelligent Energy Europe Programme (2007-13)	Financial Incentives & subsidies (e.g., grants to local and regional authorities for developing bankable sustainable energy investments).	Substantial implementation in other areas.
<b>France</b>	New buildings with low energy consumption 50kWh/m <sup>2</sup> /year (2012) (in primary energy); "positive energy" buildings (2020)	Thermal Regulation 2012 about to fully come into force; financial incentives to building refurbishment; thermal regulation for existing buildings.	Aims to reduce by 38% the primary energy consumption of existing buildings by 2020.
	European directives on eco-design and labelling	Regulations by family of products linked with energy.	
<b>Germany</b>	A wide variety of Directives and Ordinances exist in the buildings sector. National regulation includes the Energy Saving Act (EnEG) and Energy Saving Ordinance (EnEV), other measures include the On-site consultation in residential buildings.	Regulatory (Directives, audits, etc)	Substantial implementation
<b>Italy</b>	Italian National Action Plan on Energy Efficiency 2007- Decree 115/08- MD 26/6/2009  e.g. Financial incentives to building refurbishment (fiscal rebate as the minimum between EUR 100k and 55% of the refurbishment costs)  Target of 60 027 GWh/y by 2016; 77 121 GWh/y by 2020	Regulatory	Implementation underway
<b>Japan</b>	Act on the Rational Use of Energy: Reporting requirements on the energy efficiency and maintenance of buildings under construction/ reconstruction/ large-scale repair/ extension; defines energy conservation standard for appliances and equipment based on Top-runner programme; labelling programme targeted at home appliances.  The Strategic Energy Plan for Japan: sets improvement goals for building and appliance energy efficiency.	Regulatory	Implementation underway or plan to implement

<b>Korea</b>	<p>National legislation includes Article No. 66 on new building code (Building Act); Article 66-2 on new building's energy performance certification (Building Act) and Article No. 8 on public building's energy performance certification.</p> <p>For lighting, there are articles No. 22 on High-efficiency equipment certification programme and 4<sup>th</sup> Energy utilisation rationalisation master plan.</p>	Regulatory	Implementation underway. Plan to implement other measures
<b>Mexico</b>	Law for Sustainable Use of Energy and the National Program for the Sustainable Use of Energy (PRONASE).	Regulatory	Implementation is underway in some areas such as the Hipoteca Verde. In other areas, plan to implement.
<b>Russia</b>	<p>Law No. 261 of 2009 establishes a rule that buildings, structures and facilities must meet energy efficiency requirements during both the start-up phase and during their operation.</p> <p>In accordance with the legislation, effective 1 January 2011 incandescent light bulbs rated at 100 watts or higher that may be used on alternating current circuits for lighting, may not be sold in the Russian Federation.</p> <p>Approved requirements for lighting devices and electric bulbs, a variety of labelling rules, provisions and resolution on electric appliances.</p>	Regulatory Labelling	Implementation is underway
<b>Saudi Arabia</b>	A variety of policies are underway or being considered, such as plans to establish SEEC Center to develop future plans, and Management System Smart Building for buildings and building materials.		Plan to implement
<b>Spain</b>	<p>European Directives in place. Specific Spanish Regulation includes Spanish Energy Saving and Efficiency Strategy 2011-12. The Technical Building Code (RD 314/2006) and the Regulation on Building Heating Installations (RD 1027/2007) are being reviewed. Approval of a Building Energy Certification procedure for new buildings (RD 47/2007). A procedure of energy certification for existing buildings is under development. Setting of eco-design requirements for products and energy labelling. Plan 330 and Plan 2000 to reduce by 20% energy consumption by 2016 in 2 330 Public Buildings through ESCOs (National, Regional and Local). RD 1890/2008 regulates energy efficiency in street lighting installations.</p> <p>Spanish RENOVE plans for electrical household appliances and lifts.</p>	Regulatory (both European and national) Financial Incentives for energy efficiency improvements in buildings	Implementation or implementation is underway
<b>United Kingdom</b>	<p>Building, appliance and lighting are included under the EU Energy End-Use Efficiency and Energy Services Directive to deliver 9% energy savings by 2016.</p> <p>Measures include Building Regulations and certification, European appliance standards, the Carbon Emissions Reduction Target obligation on energy suppliers and information, fiscal incentives, advice and information services.</p>	A mix of codes and standards, regulatory measures (national and EU), labelling & information dissemination	Substantial implementation or implementation underway.
<b>United States</b>	National measures include standards and incentives for energy efficient housing technologies, lighting, and appliances; labelling programmes such as EnergyStar; and various public-private partnership activities such as the Commercial Building Initiative.	A mix of codes and standards, regulatory measures, financial incentives, labelling & information dissemination	Substantial implementation or implementation underway in some areas; Planned implementation in some areas.



## *Energy efficiency in industry*

The energy intensity of the manufacturing industry as a whole has been decreasing by 1.3% per year since 2005. While this may hide significant fluctuations in industrial activity caused by other factors such as the economic recession, this trend bodes well for long-term energy savings targets. The effect of these savings is significant: despite a 45% increase in output, final energy in the manufacturing sector decreased by 0.6% between 1990 and 2006 (IEA, 2009).

### *Summary of G-20 policies*

Energy efficiency policy in most countries has drawn on economic incentives to drive the market for more advanced energy efficient equipment, reducing the upfront investment cost through tax relief or subsidies, grants or loans. Many countries provide lists of eligible energy efficient equipment which act as an information or benchmarking tool for company or public sector procurement (IEA, 2011c). Turkey has established a programme of financial grants for industry-based energy efficiency projects that reduce energy intensity by 10% on average over three years in industrial establishments. Canada's ecoENERGY for Industry Programme devoted approximately CAD 18 million in information sharing and technology investments to encourage energy intensity reductions in industrial plants.

Many G-20 countries are continuing, or expanding, their promotion of energy management in industry. These policies commonly include the provision of energy management tools, training, energy manager certification and quality assurance. For example, the Australian Energy Efficiency Opportunities (EEO) program requires large energy users (consuming more than 0.5 petajoules of energy in a year) to assess their energy use and report publicly, and to the government on identified savings. Nevertheless, with few G-20 countries implementing energy management support programmes, significant room for improvement remains. There have been developments towards a global energy management standard under the International Standards Organisation (ISO), whose new ISO 50001 will establish a framework for industrial plants, commercial facilities or entire organisations to manage energy. This standard was recently approved as a Draft International Standard (DIS). Targeting broad applicability across national economic sectors, it is estimated that the standard could influence up to 60% of the world's energy use (ISO, 2011).

The opportunities for improving the energy efficiency of electric motors are often missed due to organisational structures in many companies, which separate equipment procurement from operation and maintenance. This gives the purchasing officer little reason to look beyond the lowest purchase price at potentially more efficient technologies. One policy approach to overcome this is the use of MEPS. The United States and Canada are international leaders in terms of setting motor energy-efficiency standards, as they introduced MEPS regulations for motors in the late 1990s followed by many countries such as China, Australia, Korea, Brazil, and Mexico. The European Union also passed MEPS legislation for electric motors in 2009 as an implementing measure under the Eco-design Directive. Japan is considering applying the "Top Runner Program" under Energy Conservation law to electric motors. India and Russia have not adopted MEPS but are currently considering their implementation.

Energy providers have distinct advantages and play a major role in delivering energy efficiency improvements in many G-20 countries. An ability to recover programme costs, compensation for foregone revenues due to lower sales, and acceptable levels of regulatory and other risks are among the factors that can enable energy providers to embrace this role. These have been achieved in many jurisdictions, notably in North America and parts of Europe. In Brazil, utilities collect 1% of electricity revenues, which is used to fund energy efficiency programmes as well as research and development. The EU's Energy Efficiency Plan 2011 proposes legislation that will oblige energy regulators and energy companies to take steps that enable their customers to cut their energy consumption. This could take the form of obligations to cut customer energy consumption, or

requirements to implement certain types of efficiency investment programmes, either directly or through Energy Service Companies.

Table 4 provides an overview of energy-efficiency measures, targets and progress in the industry sector within G-20 countries. Complete country submissions can be found in the document *Compendium of G-20 C3E Working Group Questionnaire Submissions*.

**Table 4** Summary of G-20 country industry efficiency policies

Country	Brief summary of Policies/Targets	Policy type	Progress/Status
<b>Argentina</b>	Decree N° 140/2007. Energy Efficiency Project in Argentina- GEF (Decree N° 1253/09)	Regulatory	Plan to implement
<b>Australia</b>	Energy Efficiency Opportunities Act (2006). Mandatory energy efficiency assessments and public reporting of results by Australia's largest energy using corporations (280) and generators covering more than 55% of Australia's energy use. The program also delivers capacity building materials and workshops to support identification and implementation of opportunities.	Regulatory	Implemented
<b>Brazil</b>	Studies are being undertaken on incentives for energy efficiency appliances.		Plan to implement
<b>Canada</b>	EcoENERGY aims at encouraging information-sharing regarding new technologies and best practices in industrial energy use, as well as the adoption of an Energy Management Standard. It is delivered through the Canadian Industry Programme for Energy Conservation (CIPEC).	Education and Outreach; Information Dissemination; Policy Processes; Project-Based Programme; Strategic Planning; Voluntary Agreement, Private Sector/Government-arranged agreements.	Substantial implementation in industry
<b>European Union</b>	Energy efficiency in industry will be tackled through energy efficiency requirements for industrial equipment, improved information provision for SMEs and measures to introduce energy audits and energy management systems. Improvements to the efficiency of power and heat generation are also proposed, ensuring that the Energy Efficiency Plan includes energy efficiency measures across the whole energy supply chain.	Regulatory	Implementation underway
<b>France</b>	European directive on CO <sub>2</sub> emissions trading scheme (reduction by 20% of the CO <sub>2</sub> emissions covered by the scheme in 2020).	Regulatory	Plan to implement, but many other industrial-related measures have yet to be implemented
<b>Italy</b>	Italian National Action Plan on Energy Efficiency 2007: Decree 115/08- MD/6/2009- Law 99/ 2009-Decree 28/2011 e.g. Financial incentives for the purchase of efficient electric motors or inverters (fiscal rebate of EUR 20k of the investment costs).	Regulatory	Implementation Underway: 8270 Gxh/y has been achieved by 2011
<b>Japan</b>	Act on the Rational Use of Energy: obliges factors of defined energy consumption levels to assign energy managers and report energy consumption. Factors consuming over 3000kl-oe must report on mid-term energy consumption plans. Factories should also endeavour to achieve 1% or more reduction in energy use annually. Strategic Energy Plan for Japan (2010): promotes use of the most advanced energy conservation/ low-carbon technologies.	Regulatory	Implementation underway

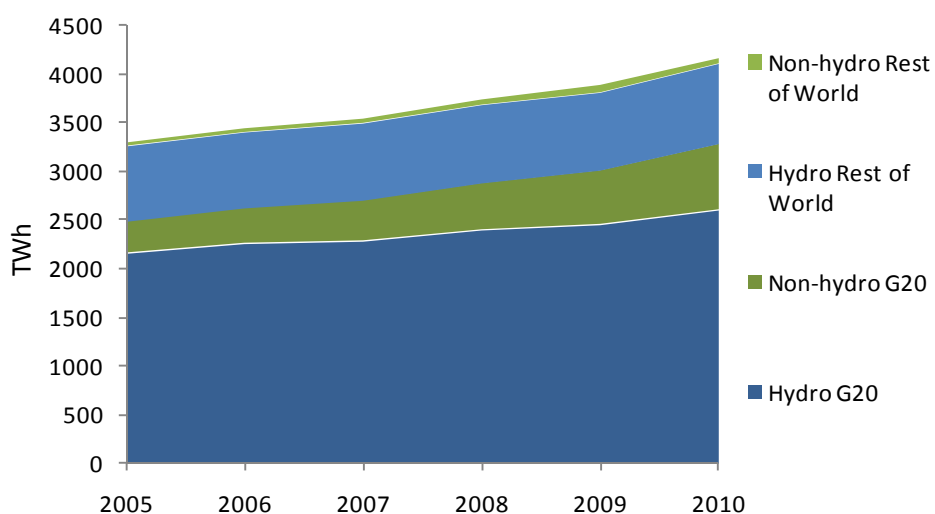
<b>Korea</b>	Specific national regulations such as Article 42 on GHG-Energy target management system and Article 32 on Energy Audit: compulsory for industrial users that exceed the baseline volume of 2000 TOE for energy.	Regulatory: Energy saving loans	In some areas, full implementation has taken place. In other areas, substantial implementation or implementation is underway
<b>Mexico</b>	To update mandatory standard of efficiency in three-phase motors; encourage the replacement of inefficient motors through policies such as Law for the Sustainable Use of Energy (LASE); National Program for the Sustainable Use of Energy (PRONASE) and various strategies for new and existing equipment.	Regulatory: certificate & information programme	In many cases, planned implementation, or implementation underway
<b>Russia</b>	Obligatory Energy audits and Energy saving programs for State regulated companies, state subsidies and guarantees for Energy Efficiency projects.	Regulatory: Auditing, Information sharing, Financial (tax incentives etc.)	Planned implementation, but for Energy audits implementation is underway
<b>Saudi Arabia</b>	Enhance Energy Efficiency (EE) and reduce intensity and Energy audits, Smart Metering, and Time of Use Tariff (TOU).	Auditing	Planned implementation, but for some measures, implementation is underway
<b>Spain</b>	A variety of specific national programmes, such as Public aid programmes, Energy Efficiency Action Plan 2008-12, Energy Efficiency Action Plan 2011-20 and Royal Decree-Law 14/2010. Voluntary agreements between the representative associations of each sector and Ministry and IDEA, and a 'Public Support Programme' are also in place.	Regulatory and Voluntary	Implementation planned, or underway
<b>United Kingdom</b>	The United Kingdom Policy Framework is set out in the United Kingdom Energy Efficiency Action Plan Update published in July 2011 which can be found at <a href="http://www.decc.gov.uk/assets/decc/11/meeting-energy-demand/international-energy/2289-uk-report-eu-enduse-esd.pdf">http://www.decc.gov.uk/assets/decc/11/meeting-energy-demand/international-energy/2289-uk-report-eu-enduse-esd.pdf</a> The framework includes action in the industrial sector including the Climate Change Agreements with energy intensive sectors of industry, the Carbon Reduction Commitment Energy Efficiency Scheme and fiscal incentives.	Financial (taxes, tax incentives, etc), Regulatory, Voluntary Agreements, information dissemination, Emissions Trading	Substantial implementation, or Implementation underway
<b>United States</b>	Measures include energy performance standards for industrial equipment, voluntary recognition partnerships such as Save Energy Now LEADERS and EnergyStar for Plants, and various technical assistance and best practice programmes, such as Industrial Assessment Centers and Green Suppliers Network.	Regulatory Voluntary Certification Education and outreach	Substantial implementation or Implementation underway in other ways

## Renewable power

At a global scale, renewable electricity generation<sup>2</sup> has been growing strongly. Between 2005 and 2010, total global generation from renewable sources increased by 22%, from 3 293 to 4 159 TWh (Figure 3). Hydropower still plays the major role, with a share of 16.2% of total electricity production in 2009, and has been increasing steadily (at an average of 17% annual growth between 2005 and 2010). The non-hydro renewable electricity generation technologies have been growing more rapidly, albeit from a much lower base, with generation doubling over the last five years. Although, its overall share of total electricity production remains low, at 3% in 2009, some individual countries, particularly in Europe, have made important strides.

<sup>2</sup> Within this section, non-hydro renewables include wind, solar, biomass, geothermal and ocean energy.

**Figure 3** Evolution of renewable electricity generation, 2005-10

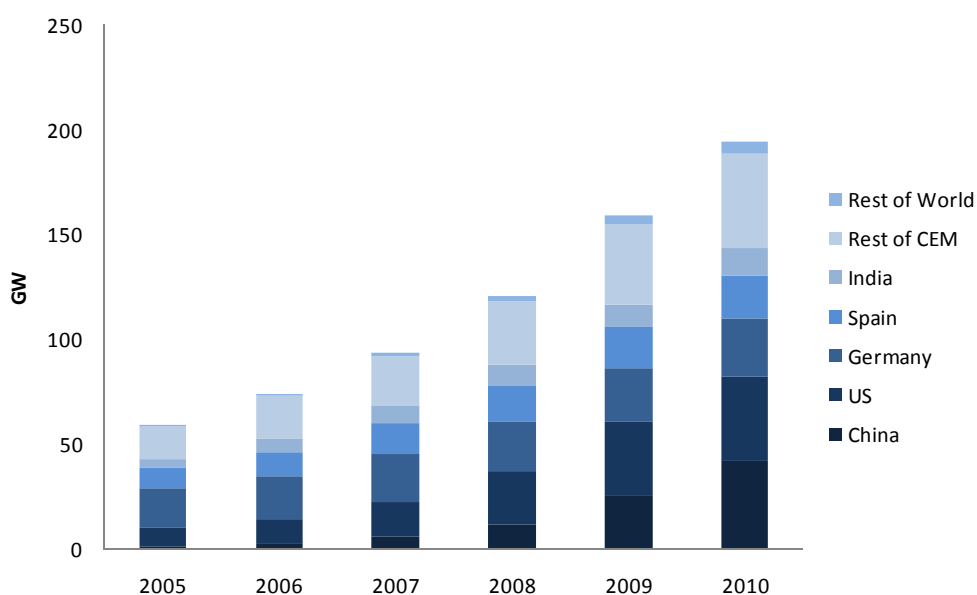


Source: Based on IEA statistics and estimates.

Figure 3 shows the importance of G-20 countries in this field. 76% of hydro generation is within the G-20 Group, and all the growth in hydro generation over the last five years has come from within the G-20 countries (notably in China). 93% of non-hydro renewable generation occurs within the G-20 countries, where generation doubled between 2005 and 2010.

While generation from all the technologies has been growing, the most dramatic growth has been in the wind and solar photovoltaic (PV) sectors. Wind capacity has grown from 59 to 194 GW over the last five years (Figure 4) with over 97% of installed capacity within G-20 countries.

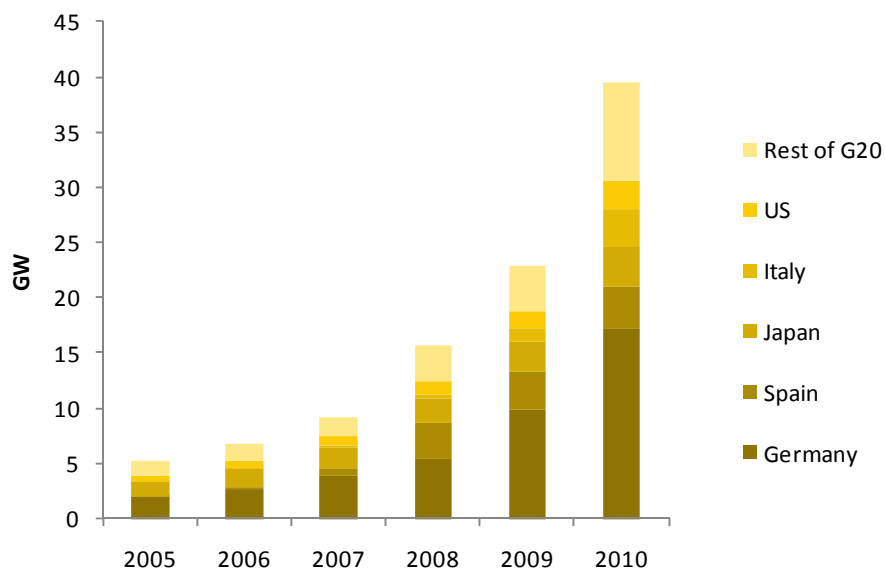
**Figure 4** Growth in wind capacity 2005-10



Source: IEA analysis based on GWEC and WWEA.

The global growth of PV in recent years has also been remarkable, albeit from a low base. Global capacity was below 5 GW in only 2005 and is today at the 40 GW mark – almost a 10-fold increase in five years. Most of this rapid growth has taken place in a very limited number of markets and nearly all the deployed PV has been installed within G-20 member countries (Figure 5).

**Figure 5** Growth in solar PV capacity 2005-10



Source: IEA analysis based on IEA PVPS, EPIA, BNEF, and other country specific sources.

### Summary of G-20 policies

Strong renewables targets and support policies that stimulate R&D, innovation and investment in renewable generation via economic support and market access policies have driven much of the recent growth in the renewables market. Seventeen of the G-20 members now have national targets for renewable electricity generation. These targets are expressed in various ways – some are targets for the proportion of renewable energy in the total energy mix, some specific to the electricity sector and some technology specific.

Since 2005, six additional G-20 countries have adopted renewable energy targets. Many other countries have extended or updated their targets, setting more ambitious and longer term goals. The United States and Canada have no federal targets, although there are some targets at the State and Provincial/ Territorial levels.

Currently, almost all G-20 countries have in place measures aimed at catalysing investment in renewable electricity generation via financing, pricing, fiscal, public bidding, and all provide some form of R&D policy support. Over the last five years many countries have refined their policies, such as feed-in tariff systems, to improve their impact on deployment or to make the policies more cost-effective. Several countries now have different mechanisms in place for different sectors or technologies. One strong recent trend is the introduction of public competitive bidding processes to auction renewable energy generation, as is the case in Mexico, Brazil, Argentina and South Africa.

While renewable energy targets are generally supported by a suite of policies and programmes which encourage and facilitate investment, financial incentives alone are not sufficient, as other non-economic barriers (like grid access or complex administrative procedures) can impede progress and increase investment costs. A comprehensive policy package is necessary to ensure that renewable energy technologies are deployed as cost effectively as possible. While the detailed

design of policies will be specific to a country's own circumstances and policy environment, experience has demonstrated that a number of policy design criteria can be applied to enable efficiency and cost effective renewable energy design. Depending on specific circumstances, these may include:

- An overall strategic approach which puts renewables in the context of the overall national energy policy goals, focussing on the technologies that can most easily meet policy needs in the short and long term;
- A transparent and stable renewables policy environment and supportive regulation, providing a suitable environment for investment;
- Appropriate tariffs that incentivise investment in the required technologies, but can be adjusted in light of technology progress and cost reductions, so as not to over reward investors and developers;
- Priority access and dispatch for renewable generators to the grid;
- Streamlined administrative procedures and a supportive institutional framework.

Table 5 below provides a summary of G-20 country renewable energy policies, including targets, financial support schemes (feed-in tariffs, tenders, tax policies, grants, green certificate schemes, tradable permits), and other renewable energy support policies. Complete country submissions can be found in the document *Compendium of G-20 C3E Working Group Questionnaire Submissions*.

**Table 5** Summary of G-20 country renewable electricity policies

Country	Targets	Financial support	Other RE support policy
Argentina	<p><b>Target:</b> 8% share of Renewable Energies in National Electricity Consumption (2016).</p> <p><b>National Programme of Hydro power tendered:</b> Chihuidos I (637MW), Cóndor Cliff (1140 MW), La Barrancosa (600 MW)</p> <p><b>National Strategic Wind Power Plan:</b> future implementation</p>	<p><b>Tender and tax policy:</b> National Promotion Scheme for the use of renewable sources destined to the production of electrical energy.</p> <p><b>Financial Support:</b> Fiduciary Fund creation destined to the payment of a renewable electricity generation bonus.</p> <p><b>Tax benefits:</b> Act N°26.190</p> <p><b>Institutional creation:</b> Secretary of Energy resolution N° 712/2009 enables supply contracts between Compañía Administradora del Mercado Mayorista Eléctrico S.A. (CAMMESA) and ENARSA in the context of the GENREN Programme.</p> <p><b>Financial support to Hydro construction:</b> Secretariat of Energy Resolution N° 762/2009</p>	<p>Law N° 26.123: Hydrogen Research and development Project</p> <p>Law N° 26.190: National Development Scheme for the Use of Sources Renewable energy for Electricity Production</p> <p>Law N° 26.093: Regulation and Promotion Scheme for Production and Sustainable Use of Biofuels</p> <p>PERMER: Energy poverty in rural areas programme</p>
Australia	<p><b>Renewable Energy Target:</b> 20% electricity from renewable sources by 2020</p>	<p><b>Renewable Energy certificates:</b> Small-scale Renewable Energy Scheme (SRES) and Large-scale Renewable Energy Target (LRET)</p> <p><b>Investment:</b> Clean Energy Finance Corporation (CEFC)</p> <p><b>Research grants:</b> Clean Technology Innovation programme; Australian Solar Institute</p> <p><b>Two for one grant funding basis:</b> Renewable Energy Demonstration programme</p> <p><b>Emerging Renewables</b> funding and program delivery for the development of renewable energy</p> <p><b>Equity Investments:</b> Renewable Energy Venture Capital Fund</p> <p><b>Installation grants:</b> Remote Indigenous Energy</p>	<p><b>R&amp;D grants</b> for solar PV and Thermal: Australian Solar Institute (ARENA program)</p> <p><b>Infrastructure Funding:</b> Connecting renewables Fund</p> <p><b>Research and demonstration programme:</b> The Solar Cities programme</p> <p><b>Carbon Tax non-technology specific fiscal policy/ tax deduction</b> for the exploration of geothermal energy</p>

		<p><b>Grants:</b> Geothermal drilling programme; National Solar Schools Program (NSSP); Low Emissions Technology Demonstration Fund</p> <p><b>Financial support:</b> Solar Flagships Programme- Financial support to large-scale demonstration of grid-connected solar plants</p> <p><b>Demonstration grants:</b> Acre Solar</p>	
<b>Brazil</b>	<p><b>Decennial Plan for Energy Expansion (PDE 2019):</b></p> <p><b>Wind:</b> 6.041 MW (expected installed capacity by 2019, PDE 2019).</p> <p><b>Hydro:</b> 116.699 MW (expected installed capacity by 2019, PDE 2019)</p> <p><b>Biomass:</b> 8 521 MW (expected installed capacity by 2019, PDE 2019)</p> <p><b>Small Hydro:</b> 6.966 MW (expected installed capacity by 2019, PDE 2019)</p>	<p><b>Tradable permits and cash grants:</b> Program for the Promotion of Alternative Sources of Electric Energy” (PROINFA).</p> <p><b>Auctions sale and purchase of electricity:</b> Wind, Biomass, Hydro</p>	<p><b>Framework policy:</b> Decennial Plan for Energy Expansion (PDE 2019)</p> <p><b>Solar PV:</b> The National Electric Energy Agency (ANEEL) and the Ministry of Mines and Energy are aiming at reducing barriers to deployment and integrating solar photovoltaic energy in the national energy portfolio</p>
<b>Canada</b>		<p><b>Credit based targeting the biomass sector:</b> Pulp and Paper Green Transformation Program (PPGTP)</p> <p><b>Premium /kWh:</b> ecoENERGY for Renewable Power</p> <p><b>Capital Grants:</b> ecoENERGY for Aboriginal and Northern Communities</p> <p><b>Tax Reduction:</b> Income Tax Act, Class 43.2 of Annex II</p>	
<b>China</b>	<p><b>12th Five Year Plan:</b> 30 GW of Biomass installed capacity by 2020; 16% of electricity from renewables by 2020 (including large hydro).</p>	<p><b>Feed-in tariff policies:</b> Wind onshore, solar PV, biomass</p> <p><b>Tenders:</b> large scale hydro, wind.</p> <p><b>Financial support:</b> Golden Sun programme</p> <p><b>Grid access and premium:</b> Renewable Energy Law</p> <p><b>Grants and premium:</b> Biogas support project</p> <p><b>Tax policy:</b> Preferential Tax Policies for Renewable Energy</p>	<p><b>Offshore Wind expansion Programme:</b> Assessment and deployment;</p> <p><b>Policy framework:</b> International Science and Technology Cooperation Programme for New and Renewable Energy</p> <p><b>Strategic planning:</b> National Climate Change Program</p>
<b>European Union</b>	<p><b>Directive 2009/28/EC- All Renewables:</b> 20% share of renewables in final energy consumption and a minimum 10% share of renewables in the transport sector by 2020</p> <p><b>Directive 2003/87/EC establishing a scheme for GHG emission allowance trading within the Community:</b> 21% GHG reduction as compared to 2005 by 2020</p>		<p><b>Framework policy with mandatory application:</b> EU-Directive 2009/28/EC</p> <p>on the promotion of the use of energy from renewable sources</p>
<b>France</b>	<p><b>Wind:</b> 11 500 MW by 2012 and 25 000 MW 2020; <b>Solar:</b> 1 100 MW by 2012 and 5 400 MW by 2020; <b>Hydro:</b> Additional capacity of 3 000 MW by 2020; <b>Biomass:</b> Additional 520 MW in 2012, and 2 300 MW in 2020; <b>Offshore wind:</b> 1 000 MW by 2012 and 6 000 MW by 2020</p>	<p><b>Feed-in tariff:</b> onshore wind, small scale solar PV, small scale biomass</p> <p><b>Calls for Tender:</b> offshore wind, large scale solar PV, large scale biomass (priority given to cogeneration), marine, hydro (priority to storage hydropower plants).</p> <p><b>Fiscal Policy and other financial incentives:</b> Finance Law 2009</p>	<p><b>Framework policy:</b> Le Grenelle de l’environnement</p>

Germany	<p><b>EU-Directive 2009/28/EC on the promotion of the use of energy from renewable sources:</b> 20% share of renewables in final energy consumption and a minimum 10% share of renewables in the transport sector by 2020.</p> <p><b>Energy Concept 2010 of the Federal Government:</b> Targets for gross final energy consumption from renewables: 2020: 18%; 2030: 30%; 2040: 45%; 2050: 60%.</p> <p>Offshore wind power 10 GW by 2020 and 20 to 25 GW by 2030</p> <p><b>Targets for electricity generation by renewable energies:</b> 2020: at least 35%; 2030: 50%; 2040: 65%; 2050: 80%</p>	<p><b>Feed-in tariff and priority access for solar:</b> Renewable Energy Sources Act (EEG), wind, biomass and geothermal electricity</p> <p><b>Infrastructure investments:</b> Grid Expansion Acceleration Act (NABEG)</p> <p><b>Investments in R&amp;D:</b> Act establishing an Energy and Climate Fund 2011 (EKFG-ÄndG)</p>	<p><b>Policy framework:</b> Grid Expansion Acceleration Act (NABEG)</p> <p><b>Policy framework:</b> Directive 2009/31/EC on the geological storage of carbon dioxide</p> <p><b>R&amp;D investment:</b> From 2011 to 2014, EUR 3.4 billion will be invested into the support of the research on energy. About 80% of the funds will be invested into research on renewable energy (EUR 1.3 billion) and energy efficiency (EUR 1 2 billion)</p> <p>The research will be financed through federal budget and the German Energy and Climate Fund (ECF)</p>
India	<p><b>Targets:</b> 10% electricity from renewable sources by 2012</p>	<p><b>Electricity Act 2003:</b> Renewable Purchase Obligation (RPO) mandated by State Electricity Regulatory Commission (SERC)</p> <p><b>2006 Tariff policy- Feed-in tariffs established by CERC and SERC:</b> Wind, small hydro, solar PV and thermal</p> <p><b>Grants and feed-in premium:</b> National Solar Mission</p> <p><b>Subsidies and RD&amp;D:</b> Central Financial assistance for Biogas plants</p> <p><b>Quota policy with green certificates:</b> Renewable Energy Certificates system March 2011</p>	<p><b>Framework Policy:</b> Electricity Policy 2005</p> <p><b>National Action Plan on Climate Change (NAPCC) 2008:</b> Dynamic Minimum Renewables Purchase Standard (DMRPS) and identification of 8 core Solar Missions</p> <p><b>RD&amp;D grants:</b> Solar cities development programme</p>
Indonesia	<p><b>Target:</b> 15% of electricity demand from renewable sources by 2025</p>	<p><b>Guaranteed price:</b> Purchase tariff for electricity from geothermal</p> <p><b>Tax incentives:</b> Geothermal exploration programme</p>	<p><b>Framework policy:</b> National Energy Blueprint</p>
Italy	<p><b>National Renewable Energy Action Plan (NREAP)/ Legislative Decree no.28/2011</b></p> <p><b>Directive 2009/28/EC, Electricity from RES:</b> 26.39% by 2020, out of which 5.33% from wind, 3.03% from solar, 11.21% from hydro, 5.01% from biomass, 1.80% from geothermal</p>	<p><b>Feed-in Tariff/ Conto Energetico I to IV:</b> Solar PV, biomass, hydropower, geothermal, tidal and wave</p> <p><b>Feed-in tariff adjustment / Call for tenders:</b> Decree 28 May 2011</p> <p><b>Feed-in tariff for small scale renewable:</b> All renewable electricity</p> <p><b>Tradable certificates:</b> Provisions for the Green energy certificate system</p>	<p><b>National electric system research:</b> RD&amp;D</p>
Japan	<p><b>General target:</b> 10% priority energy supply from renewable sources by 2020</p>	<p><b>Feed-in tariff:</b> Solar PV</p> <p><b>Grants:</b> Residential Solar PV programme</p> <p><b>Renewable Portfolio Standard System:</b> Electricity from renewable sources</p>	<p><b>Framework policy:</b> Comprehensive review of Japanese energy policy</p> <p><b>Act on purchase of Renewable Energy Sourced Electricity Utilities:</b> Obligation to Purchase for utilities the electricity from Solar PV, wind power, hydraulic power, geothermal and biomass</p>



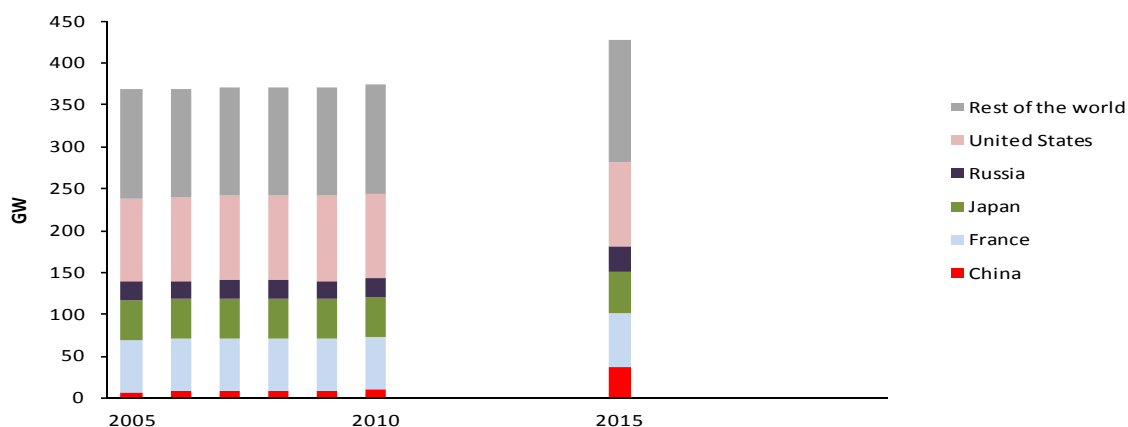
Mexico	<p><b>National Energy strategy:</b> 35% of total power capacity coming from clean technologies by 2024</p> <p><b>Special Program for Renewable Energy 2009:</b> 7.6% of total capacity coming from renewable technologies by 2012</p>	<p><b>Mandate and subsidies:</b> Law for the development of renewable energy and energy transition financing.</p>	<p><b>Targets and framework policy:</b> 2008 Renewable Energy Law (LAERFTE)</p> <p><b>Framework policy:</b> National Energy Strategy 2010</p> <p><b>Renewable energy strategy design:</b> Special Program for Renewable Energy 2009</p>
Republic of Korea	<p><b>Korea 1<sup>st</sup> National Energy Master Plan 2008-30:</b> Energy intensity will be improved by 11.3% by 2012 and to 46.7% by 2030</p> <p><b>3<sup>rd</sup> National Renewable Energy Plan:</b> 11.0% of renewable energy share in total primary energy supply by 2030, including 4 155 ktoe from wind; 1 364 ktoe from solar PV; 1 447 ktoe from hydro; 1 357 ktoe from biomass; 1 261 ktoe from geothermal; 1 540 ktoe from marine power.</p> <p><b>Road-map for off-shore wind power:</b> 2.5GW by 2019</p>	<p><b>Investment and grants:</b> 3<sup>rd</sup> National Renewable Energy Plan.</p> <p><b>Feed-in tariff, subsidies, certification scheme:</b> Act on the promotion of the development use and diffusion of new and renewable energy (enforced on April, 2010).</p> <p><b>Demonstration investment:</b> Road-map for off-shore wind power.</p>	<p><b>Framework policy:</b> Korea 1<sup>st</sup> National Energy Plan 2008-2020.</p> <p><b>Portfolio Standard by 2012:</b> Act on the promotion of the development, use and deployment of new and renewable energy.</p>
Russia	<p><b>Regulation # 1p of the RF government dated 8 January 2009: Target</b> 1.5 % of electricity generation from RES in 2010; 2.5 % by 2015 and 4.5% by 2020</p>	<p><b>Federal subsidies Framework Policy:</b> Federal Law "On Power Industry" (as of 26 March 2003 No.35-FZ (35-3))</p> <p><b>Mandate and Financial incentives:</b> State Policy guidelines for promoting renewable energy in the power sector</p> <p><b>Eligibility criteria for subsidies allocation:</b> The Resolution of the Government of the RF # 850 as of 20 October, 2010.</p>	<p><b>Framework policy:</b> The Resolution of the RF Government # 1715-p as of November 13, 2009</p> <p><b>Infrastructure development:</b> The Resolution of the RF Government # 823 "On Plans and Programs of Prospective Electric Power Industry Development</p> <p><b>Monitoring system:</b> Order # 607 of the Ministry of Energy of RF as of 17 December 2010</p>
Saudi Arabia			<p>King Abdullah City for Atomic &amp; Renewable Energy (KACARE): Framework policy and research centre on solar, wind, biomass and geothermal energies.</p> <p><b>CDM Projects</b> for solar, wind, biomass and geothermal.</p>
South Africa	<p><b>Integrated resource plan for electricity:</b> 13% of total electricity demand from renewables by 2020, of which 4 759 MW or 12.7% of total capacity from hydro; 9 200 MW or 10.30% of total capacity from wind; 1 200 MW or 1.3% of total capacity from CSP and 8 400 MW or 9.4% of total capacity from PV.</p>	<p><b>Feed-in tariff:</b> Biomass, hydro, solar PV and thermal, wind</p> <p><b>Tenders / public bidding process:</b> All renewable energy projects</p>	<p><b>Framework policy:</b> White paper on renewable energy</p>

Spain	<p><b>Directive 2009/28/EC:</b> 20.8% of renewable energy share in gross final energy consumption</p> <p><b>Renewable Energy Plan 2011-20 (final approve still pending);</b> 40% of electricity generated from renewable, of which 35 000 MW of wind onshore, 750 MW of wind offshore, 7 250 MW of solar PV, 4 800 MW of solar thermal, 13 861 MW of hydro power, 1 950 MW of biomass, 50 MW of geothermal and 100 MW of marine power.</p>	<p><b>Research grants:</b> The National Plan for Scientific Research, Development and Technological Innovation (R&amp;D&amp;I)</p> <p><b>FIT for all renewable electricity:</b> Royal Decree 661/2007.</p> <p><b>Pre-registration obligation for FIT entitlement:</b> Royal Decree Act 6/2009</p> <p><b>Royal Decree 1614/2010 on electrical energy from wind and thermal electric technologies:</b> Limited hours per year eligible to be supported by a feed in tariff</p> <p><b>FIT for solar PV:</b> Royal Decree 1565/2010 on new tariff regulation for the production of photovoltaic electrical energy</p> <p><b>Net metering:</b> distributed generation</p> <p><b>ICO Financing line:</b> Low interest loans</p> <p><b>Royal Decree 1028/2007:</b> authorisation administrative procedure for offshore wind plants</p>	<p><b>Renewable Energy Plan 2011-20</b> (still to be approved by Spanish Government)</p> <p><b>Spanish Strategy on Climate Change and Clean Energy 2007-2012-2020:</b> Measures will encourage the development of biomass, thermoelectric and photovoltaic solar, specifically encouraging small PV facilities (less than 5 kW)</p> <p><b>Promotion of competitiveness:</b> Sustainable Economy Act (Law 2/2011)</p> <p><b>Pre-registration guidelines for FIT entitlement:</b> Royal Decree Act 6/2009</p> <p><b>Permit application procedures:</b> Royal Decree 1028/2007 on the authorisation administrative procedure for offshore wind plants</p>
Turkey	<p><b>Renewable Energy Law 2010:</b> 30% electricity from renewable sources by 2023</p>	<p><b>Renewable Energy Law 2010:</b> Feed-in tariff (wind, solar, biomass, geothermal) and bonus payments</p>	<p><b>Framework policy:</b> Law on geothermal resources and natural mineral water; Strategic Plan 2010</p>
UAE	<p><b>Target:</b> 7% renewable energy generation capacity by 2020</p>		<p><b>Feasibility studies / Framework policy:</b> Dubai Integrated Energy Strategy 2030</p> <p>Masdar demonstration project</p>
United Kingdom	<p><b>Directive 2009/28/EC/ 2011 Renewables Roadmap:</b> 15% of energy consumption from renewable sources by 2020.</p>	<p><b>Feed-in tariff Law:</b> Wind, solar PV, Hydro, bioenergy</p> <p><b>Renewable Obligation Policy:</b> Mandate and Quota system</p>	<p><b>Framework policy:</b> Renewables Roadmap</p> <p><b>Framework Policy:</b> Energy Act; Climate change and sustainable energy Act</p>
United States	<p>Although there is not a Federal target, 24 of the 50 US states have Renewable Portfolio Standards in place</p>	<p><b>Tax policy:</b> Examples include Production Tax Credits; Investment Tax Credits; Residential Renewable Energy Tax Credit</p> <p><b>Financial incentives:</b> Examples include Sustainable Energy Resources for Consumers (SERC) Grants; State and Tribal Energy Programs; SunShot Initiative (\$1 a Watt Initiative); Rapid Deployment of Renewable Energy and Electric Power Transmission Projects; Renewable Energy Production Incentive (REPI)</p> <p><b>Grants:</b> Renewable Energy Deployment Grants</p>	<p>Other policy support for renewable energy deployment includes codes and standards, education, training, and workforce development at DOE Programmes for Solar, Wind, Water Power, Geothermal, and Biomass. This includes activities such as the Federal Wind Sitting Information Center, Solar America Showcases, Woody Biomass Utilization Initiative, Center for Geothermal Technology Transfer, State Climate and Energy Partnership Program, and others</p>

## Nuclear power

Deployment of new nuclear capacity has been largely flat over the last number of years – worldwide operational installed nuclear capacity increased from 370 GWe at the end of 2005 to 375 GWe by the end of 2010. Worldwide electricity generation from nuclear power plants has also remained flat at around 2 600 TWh. There was, however, a significant number of construction starts in 2010. Given the nuclear policy reviews following the recent major incident at the Fukushima Daiichi nuclear power plant in Japan, it is however uncertain whether the previously planned rate and scale of expansion will be maintained.

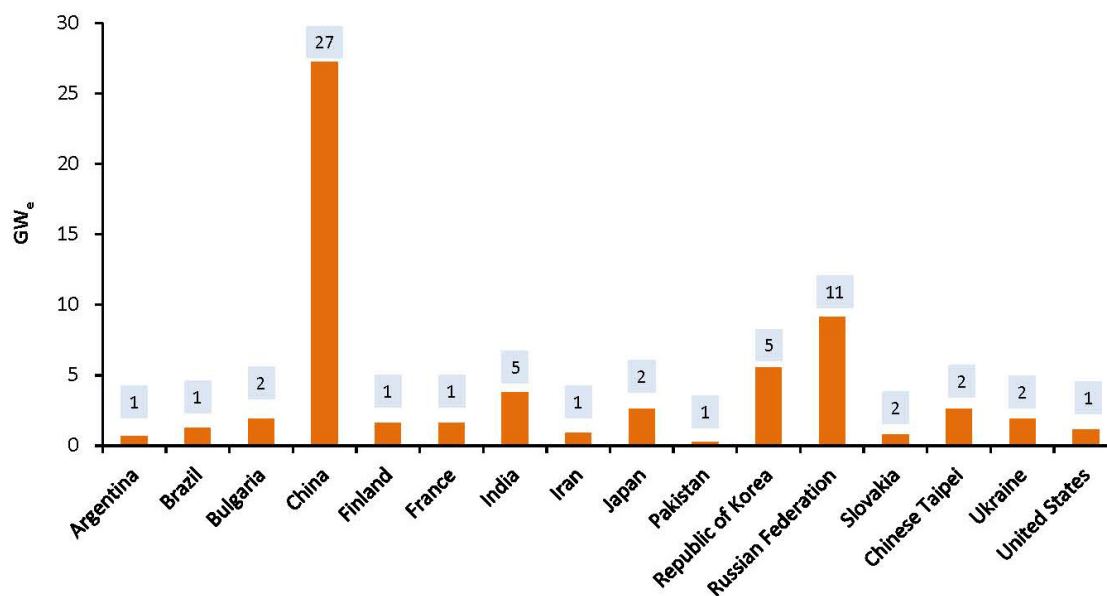
**Figure 6** Global nuclear capacity and estimated 2015 capacity



Source: IAEA PRIS database, 2011.

At the end of 2010, there were 65 plants under construction, of which 27 were in China, although some have been in construction for a number of years. It is notable that the number of new construction starts in 2010 was the highest since the 1980s.

**Figure 7** Nuclear capacity under construction globally and number of reactors



Source: IAEA PRIS database, 2011 and country submissions.

### Summary of G-20 policies

Following the Fukushima accident, there was a general review within countries of the safety of existing plants and a reconsideration of new build programmes. As a result, Germany announced an accelerated phase-out of nuclear by 2022, Switzerland announced a phase-out but without defined timelines to date and Italy voted in a referendum not to re-introduce nuclear. Elsewhere, many countries committed to a comprehensive review of existing plants, either at a national level or, in some cases, such as Europe as a co-ordinated and harmonised process. The results of this latter process are expected towards the end of 2011 and involve testing of the capability of the nuclear

power plants to withstand external events and prolonged loss of cooling functions, in addition to the adequacy of their accident management.

However in other countries there was a reconfirmation of stated intentions to introduce new build in Russia, the Czech Republic, Turkey and the United Arab Emirates, while in the United Kingdom and the United States, the value of nuclear as part of a diverse energy mix was restated. It is clear that, overall, there will be a slow-down in nuclear build rates and it is uncertain whether growth targets will be achieved in the expected timeframe. Public confidence has been significantly affected and re-establishing trust will be a long and challenging task. However it is not clear how extensive this period of reconsideration will be.

Table 6 provides a summary of G-20 nuclear energy targets, policy frameworks and current progress. Complete country submissions can be found in the document *Compendium of G-20 C3E Working Group Questionnaire Submissions*.

**Table 6** Summary of G-20 countries nuclear policies

Country	Targets included in national legislation	Policy frameworks and national priorities	Current progress
<b>Argentina</b>	Construction of a 4th nuclear power plant, productive life extension of Embalse power plant, completion of Atucha II nuclear power plant, construction of reactor CAREM.	Law N° 26.566 Declares of national interest Embalse power plant life extension as well as CAREM project and the construction of the fourth Nuclear Power Plant.  Additionally, the Law gives powers to expropriate property for the construction of the IV Nuclear Power Plant.	Atucha II is already testing its primary circuits. Contracts for life extension to Embalse have recently been signed.
<b>Australia</b>		Environment Protection and Biodiversity Conservation Act 1999 prohibits nuclear construction for power generation.	
<b>Brazil</b>	3 412 MW by 2019	Resolution No.3 of the Brazilian National Energy Policy Council (CNPE), published on 25 June 2007.	The increase of 70% (from 2 007MW to 3 412 MW) in the installed capacity of nuclear power plants in Brazil shall be achieved with the entry into operation of Nuclear Power Plant Angra III, scheduled for June 2015.
<b>Canada</b>		Nuclear Energy Act, Nuclear Safety and Control Act, Nuclear Fuel Waste Act, Nuclear Liability Act	One new reactor under official consideration
<b>European Commission</b>	No targets at the EU level. Nuclear Illustrative Programmes indicates non-binding production targets and required investments.	Legislation based on the Euratom Treaty. Focusing mainly on safety and radiological protection including: the Directive establishing a Community framework for the nuclear safety of nuclear installations 2009 and Directive on the management of spent fuel and radioactive waste 2011.	The Nuclear Safety Directive has been transposed into national legislation in most of the Member States.  The Waste Directive must be transposed before 23 August 2013 and Member States have to submit their first national programmes in 2015.
<b>France</b>	Plans to construct two new EPR power plants		One EPR is under construction (Flamanville), the other one (Penly) is in the authorisation process
<b>Germany</b>	Planned phase-out of nuclear power use for commercial power generation by 2022 at the latest.	Amendment to the Atomic Energy Act July 2011 provided for the phase out of nuclear power to be replaced with renewable power.	Eight (of 17) nuclear power plants were shut down in March 2011 or rested disconnected from the grid for a "moratorium" period. With the amendment to the Atomic Energy Act entered into force on 6 August 2011, they will not go back on-line.

<b>India</b>	The eleventh 5 year plan (2007–12) included the addition of 3.8 GW of nuclear capacity. National Power Corporation of India Ltd foresees 11 GW added under the 12 <sup>th</sup> Plan. Report of the <i>Expert Committee of the Planning Commission on Integrated Energy Policy</i> sees a total installed capacity of 29 GW by 2020 under an optimistic scenario.	11 <sup>th</sup> 5 year plan (2007–12) produced by the Planning Commission of the Government of India.  Report of the Planning commission Expert Committee on Integrated Energy Policy August 2006.	The Kaiga 4 PHWR reactor was grid connected on 19/01/2011 with 202 MW gross capacity. A further six reactors are currently under construction in India with a total capacity of 3.76 GW net capacity.
<b>Italy</b>			
<b>Japan</b>	The Strategic Energy Plan for Japan is now under radical review due to the Great East Japan Earthquake and Accident at Fukushima Dai-ichi Nuclear Power Station in March 2011.		
<b>Korea</b>	2030: 27.8% (nuclear energy share in total primary energy supply) 2030: 59% (Nuclear energy share in power generation).	Korea 1st National Energy Plan 2008-2020. Establishes the national plan for managing energy supply and demand in the long-term including nuclear energy.  This plan includes policies on the construction of additional nuclear power plants, the national management policy on spent fuels, nuclear safety and public acceptance.	2010: 12.2% (nuclear energy share in total primary energy supply) 2010: 31.1% (Nuclear energy share in power generation)
<b>Mexico</b>	35% of total power capacity coming from renewable, large hydro and nuclear by 2024.	National Energy Strategy	Both units of Laguna Verde plant operating at 800 MWe per unit, in increase of 20% from previous levels.
<b>Russia</b>	50-53 GW by 2020. Increasing the share of nuclear by 2030 to between 25% to 30%.	The regulation of the Russian Federation Government (2008) ensures the growth of nuclear power to 2020.	Under Realisation
<b>Saudi Arabia</b>	Established the King Abdullah City for Atomic & Renewable Energy (KACARE) to develop, disseminate and deploy technologies;		Nuclear plan under consideration
<b>Spain</b>			
<b>United Arab Emirates</b>	5.6 GW of nuclear power to be installed between 2017 and 2020 to meet 25% of electrical demand.		USD 20 billion contract awarded to KEPCO, total project value estimated at USD 40 billion.
<b>United Kingdom</b>	No specific targets. National Policy Statements identify a need of 18 GW of non-renewable capacity by 2025.	The nuclear National Policy Statements (NPS) identified eight sites that could host a nuclear power station by 2025.	Three energy consortia have announced plans to develop at five of the eight sites identified in the NPS. The first reactor is expected online by 2018/2019.
<b>United States</b>		Energy Policy Act 2005 provides for \$4.3 billion in tax breaks for nuclear power; Early Site Permits and Combined Construction and Operating License streamlines nuclear power licensing; Price-Anderson Act indemnifies industry against incidents over USD 10 billion.	

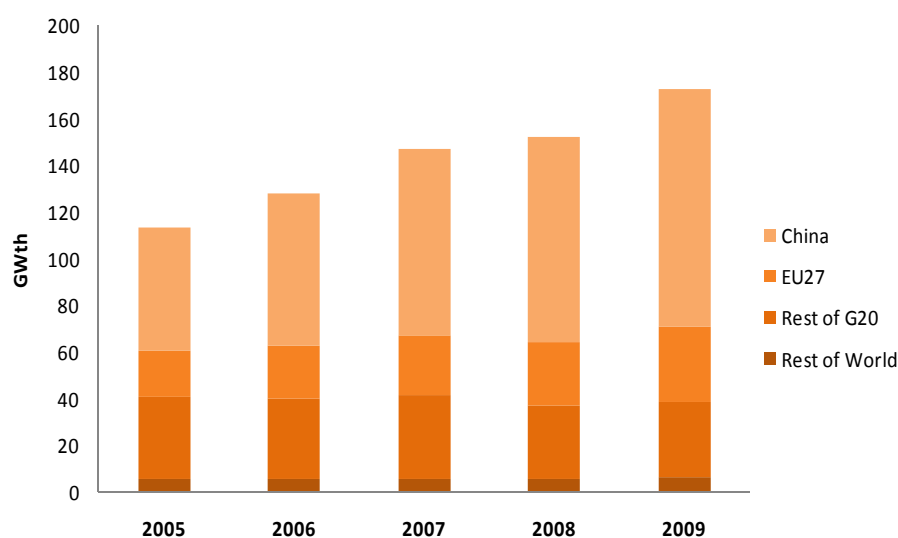
## Renewable heating and cooling

The use of renewable energy systems for both domestic and industrial heating and cooling applications has received relatively little attention compared with renewable electricity or transport biofuels. Renewable heating can principally be provided by three technologies – biomass, solar heating and geothermal. In regions where cooling has a greater energy demand than heating, especially during peak summer periods, renewable energy cooling systems show good potential for further development. Space cooling can, for example be supplied through the use of heat-driven adsorption chillers as an alternative to electrically driven compression chillers. This section focuses predominantly on renewable heat progress as country submissions focused mainly on heat policies.

Overall the renewable heat sector is expanding, with growth of approximately 6% from 2005-09. Biomass makes the largest contribution, particularly to meet heating and cooking needs within the “traditional biomass” sector, where biomass is often used inefficiently and causes human health and indoor pollution challenges. Given lack of data, distinguishing between traditional and “modern” efficient use of biomass for industry and commerce is difficult.

There has been growth in the geothermal heating sector in countries endowed with a significant geothermal resource. The strongest growth has been experience in the solar heating sector, particularly as a result of rapid growth in China, where deployment has doubled in the last five years (Figure 8).

**Figure 8** Trends in global capacity of solar heating systems, 2005-09



Source: IEA analysis based on data from the IEA Solar Heating and Cooling Implementing Agreement.

### Summary of G-20 policies

Stimulating a market for heat requires addressing challenges that are different and sometimes more difficult to overcome than in the electricity and transport sectors. A number of key barriers to renewable heat deployment may deter deployment, some associated with the overall characteristics of the heat sector and some specific to the introduction of renewable options. Table 7 below outlines a number of these heat, and renewable heat specific barriers.

**Table 7** Barriers to heat and renewable heat deployment

Barriers to heat (general)	Barriers to renewable heat
<b>Fragmented market: millions of owners/developers, district heating operators and industries</b>	Renewable heat production should be close to heat sink (limited transportability, no grid for surplus, limited storage)
<b>Gatekeepers between supply and demand (installers, architects)</b>	Heat demand can be variable over time (space heating is seasonal)
<b>Dynamics of heat market: space heating demand declining, power for heat in new buildings</b>	Heat is a heterogeneous commodity: differing temperatures in both demand and renewable heat supply
<b>“Split incentive” between building owner and consumer/tenant</b>	

Based on the analysis of submitted country information, summarised in Table 8:

Twelve of the countries have targets for renewable heat, eight of which have targets covering a range of technologies, and a further four with targets specific to solar heating technologies;

Eleven countries also have active measures to promote renewable heat, including 10 countries with market incentives to encourage investment – often via capital grants and rebates. The United Kingdom is the first country to implement a specific feed-in-tariff system to the heat sector. Spain has also planned to establish a specific incentive schemes for renewable heat production through Energy Service Companies. Again the largest emphasis is on solar thermal systems.

As noted above, in past, renewable heat policies have not received as much attention as those for the electricity and transport sectors. The G-20 country policy overview confirms that this is still the case, since fewer countries have targets and policies in place than for the other renewable sectors. The analysis, however, also shows growing recognition that renewable heat technologies can play an important role in meeting heating needs, with cost effective and technically proven technologies applied in countries where resource and market conditions are favourable.

Table 8 below provides an overview of renewable heat targets, financial support, and other policies in place across G-20 countries. Where renewable cooling policies were submitted by countries, these were included in the table. Complete country submissions can be found in the document *Compendium of G-20 C3E Working Group Questionnaire Submissions*.

**Table 8** Summary of G-20 country renewable heat policies

Country	Targets	Financial support	Other RE support policy
<b>Argentina</b>			
<b>Australia</b>		<b>Grants:</b> The Renewable Energy Bonus Scheme – Solar Hot Water Rebate (REBS) <b>Grants for solar hot water systems:</b> National Solar Schools Program (NSSP)	
<b>Brazil</b>	Solar thermal target: 15 million m <sup>2</sup> installed in 2015, from about 7 million m <sup>2</sup> in 2011	<b>Financial incentives:</b> The National Plan for Energy Efficiency (PNEf) – Will be published soon, as well as a correlated Action Plan	
<b>Canada</b>		<b>Credit based support programme:</b> Pulp and Paper Green Transformation Program (PPGTP) <b>Tax Reduction:</b> Income Tax Act, Class 43.2 of Annex II <b>Capital grants:</b> ecoENERGY for Renewable Heat; ecoENERGY Retrofit – Homes	<b>Efficiency Standard:</b> Energy Efficiency Regulations for Ground or Water-Source Heat Pumps

<b>China</b>	<b>12<sup>th</sup> Five year Plan Solar thermal:</b> 300 million m <sup>2</sup> by 2020	<b>Renewable energy Law:</b> Guarantee access to heat pipelines and financial support	
<b>European Union</b>	<b>Directive 2009/28/EC</b> <b>Directive 2003/87/EC</b> Target 21% GHG reduction as compared to 2005, establishing a scheme for GHG emission allowance trading within the Community		
<b>France</b>	<b>National Renewable Energy Action Plan for France :</b> General: 23% of renewable energy in the gross final energy consumption in 2020 <b>Solar thermal:</b> 185 ktoe by 2012, 927 ktoe by 2020 <b>Biomass:</b> 10 970 ktoe by 2012, 16 455 ktoe by 2020 <b>Geothermal:</b> Excluding geothermal energy from heat pumps: 195 ktoe by 2012, 500 ktoe by 2020 <b>Renewable energy from heat pumps</b> (geothermal or aerothermal): 1 300 ktoe in 2012, 1 850 ktoe in 2020 <b>Renewable heat from district heating :</b> 775 ktoe in 2012, 3 200 ktoe in 2020	<b>Grants:</b> Fond Chaleur <b>Tax Policy and other financial incentives:</b> Finance Law 2009	<b>Framework policy:</b> Le Grenelle de l'environnement
<b>Germany</b>	EU-Directive 2009/28/EC on the promotion of the use of energy from renewable sources: 14% by 2020 Energy Concept of the Federal Government 2010	<b>Obligation of use:</b> Renewable Energies Heat Act 2009 <b>Market Incentive Program (MAP) –</b> Investment cost subsidies and low-interest loans	
<b>India</b>	<b>Solar thermal:</b> 15 million m <sup>2</sup> by 2017 / 20 million m <sup>2</sup> by 2022		
<b>Indonesia</b>	No regulation		
<b>Italy</b>	<b>NREAP- Legislative Decree no.28/2011:</b> Renewable heat in total final energy consumption: 17.09%, out of which 2.59% from solar, 9.27% from biomass, 0.49% from geothermal, 4.74% from heat pumps		
<b>Japan</b>		<b>Grants:</b> Renewable Heat programme Framework	<b>Framework policy:</b> Comprehensive review of Japanese energy policy
<b>Mexico</b>	<b>National Solar Thermal Plan (PROCALSOL):</b> 1.8 million square meters of solar heaters by 2012	<b>Grants:</b> National Solar Thermal Plan (PROCALSOL)	
<b>Republic of Korea</b>	<b>3<sup>rd</sup> National Renewable Energy Plan:</b> Renewable heat targets by 2030 are: 1 882 ktoe from solar, 1 357 ktoe from biomass for electricity and heating & cooling, 1 261 ktoe from geothermal for electricity and heating & cooling		
<b>Saudi Arabia</b>			King Abdullah City for Atomic & Renewable Energy (KACARE), KACST: Research programme, disseminate and deploy technologies



South Africa		<b>Rebate programme:</b> Solar water heating programme	<b>Framework policy:</b> White paper on renewable energy
Spain	<b>Directive 2009/28/EC Renewable and Energy Plan 2011-20:</b> Renewable heat target of 18.9% by 2020, with 644 ktoe from solar thermal, 4 653 ktoe from biomass, 9.5 ktoe from geothermal and 50.8 ktoe from heat pumps	<b>Obligation of use:</b> Technical Building Code (RD 314/2006) currently under review. Local Solar Ordinances in over 70 municipalities <b>Subsidies:</b> Programme for promoting solar thermal energy in buildings (SOLCASA); Programme for promoting biomass energy in buildings (BIOMCASA); Programme for promoting geothermal energy in buildings (GEOTCASA). Programme for promoting biomass, solar thermal and geothermal energy in big tertiary buildings. Programme to foster renewable sources energy production for thermal uses (ICAREN) <b>Soft loans-</b> (ICO-IDAE)	<b>Framework policy:</b> Renewable and Energy Plan 2011-20; Certification and labelling of new and existing buildings
Turkey			<b>Framework Policy:</b> Strategic Plan 2010
UAE			<b>Demonstration:</b> Masdar demonstration project
United Kingdom	<b>Directive 2009/28/EC Renewable:</b> 12% renewable heat by 2020	<b>Tariff payment for renewable heat generation:</b> Renewable Heat Incentive (RHI) – Tariff payment for metered renewable heat from solar thermal, biomass, geothermal, Heat pumps, biogas combustion, and biomethane	<b>Framework policy:</b> Renewable Energy White Paper
United States		Examples include Investment tax credits, Modified Accelerated Cost-Recovery System, Biomass Crop Assistance Program, Residential Renewable Energy Tax Credit	<b>Education &amp; information dissemination:</b> Clean Energy Application Center; Utility Solar Water Heating Initiative; Solar Energy Technologies Program; Geothermal Technologies Program

## Carbon capture and storage

Given that the world's dependence on fossil fuels seems set to continue in the near- and medium-term, CCS constitutes a key mitigation technology<sup>3</sup>. However, there are only eight large-scale CCS projects in operation today, five of which are in G-20 countries, including the Rangely Enhanced Oil Recovery (EOR) project in the United States, and the Weyburn-Midale EOR project in Canada. The latter project stores CO<sub>2</sub> in Canada, captured from production of synthetic natural gas in the United States. While existing there are a further 57 large-scale fully integrated projects at various stages in the development process in the G-20 group. Figure 9 shows the geographical distribution of these planned projects and their current status of development. Projects are categorised by key development phases of a project, defined as follows<sup>4</sup>:

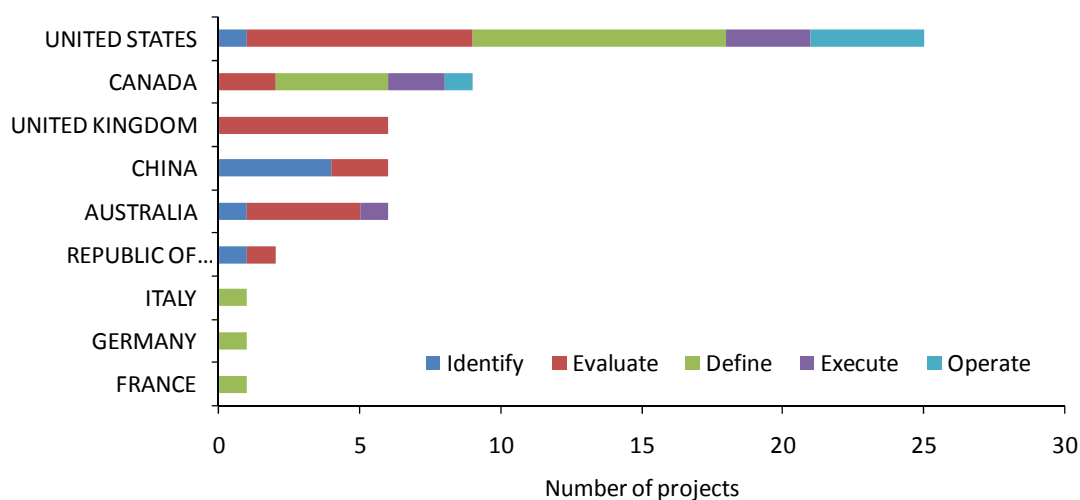
1. **Identify:** Establish preliminary scope and business strategy.
2. **Evaluate:** Establish development options and execution strategy.
3. **Define:** Finalise scope and execution plan.

<sup>3</sup> According to the IPCC Special Report: Carbon Dioxide Capture and Storage (IPCC, 2005), CCS contributes 15–55% to the cumulative mitigation effort worldwide until 2100.

<sup>4</sup> Global CCS Institute, *Global Status of CCS 2011*.

4. **Execute:** Detail and construct asset.
5. **Operate:** Operate, maintain and improve asset.

**Figure 9** Operating and planned projects in the G-20 group of countries



Source: Global Carbon Capture and Storage Institute (GCCSI) database, 18 October, 2011.

### Summary of G-20 policies

Successful deployment of CCS technology beyond a limited number of demonstration projects requires: continued R&D, in particular on novel CO<sub>2</sub> capture technologies, regulatory frameworks to ensure that projects are safe, effective, and that the expected costs of deploying CCS are appropriately allocated; and policies that incentivise use of CCS (or, more broadly, reductions in emissions). Many G-20 governments have acted on one or both of these barriers. Table 9 presents a summary of CCS regulatory framework development and large-scale integrated project funding programmes in G-20 countries. Complete country submissions can be found in the document *Compendium of G-20 C3E Working Group Questionnaire Submissions*.

**Table 9** Summary of G-20 country CCS regulatory development and large-scale project funding

Country	Regulatory framework development and deployment incentives	Funding programmes for large-scale integrated demonstration projects*
<b>Australia</b>	Comprehensive regulation in place federally and in three states; approval to draft legislation in a fourth†	CCS Flagships Programme (AUD 1.68bn)
<b>Canada</b>	Draft, federally regulated NGCC-parity emissions intensity performance standard for all new coal-fired power plants (and those units reaching the end of economic life), equivalent to a coal-fired power plant capturing and storing approximately 70% of its CO <sub>2</sub> emissions, under public review; comprehensive regulations for CO <sub>2</sub> storage in place in Alberta with ongoing CCS regulatory review, and development processes ongoing in British Columbia, Saskatchewan, and Nova Scotia to address CCS policy barriers.	Clean Energy Fund (CAD 610m) Alberta CCS Fund (CAD 2bn) SaskPower Boundary Dam Project (CAD 240m) ecoENERGY Technology Initiative (CAD 151m)
<b>European Union</b>	EU CCS Directive- Directive 2009/31/EC on the geological storage of carbon dioxide, establishes a common, comprehensive framework for CCS in the EU†	European Energy Programme for Recovery (EUR 1bn) NER300 Programme (total amount will depend on the carbon price)
<b>France</b>	Ban on construction of coal-fired power plants without CCS; finalising transposition of the EU CO <sub>2</sub> Storage Directive;† considering additional regulations for geologic storage†	

<b>Germany</b>	Bill transposing the EU CO <sub>2</sub> Storage Directive before parliament	
<b>Indonesia</b>	Assessing needs for and developing geologic storage-specific regulations†	
<b>Italy</b>	Transposition of EU CO <sub>2</sub> Storage Directive ongoing†	
<b>Japan</b>	Assessing needs for geologic storage-specific regulations†	
<b>Mexico</b>	Considering inclusion of CCS in the National Energy Strategy as a “clean technology”; assessing needs for geologic-storage specific regulations†	
<b>Saudi Arabia</b>	Targeting development of a CCS-EOR demonstration for 2013	
<b>South Africa</b>	Assessing needs for and geologic storage-specific regulation development†	
<b>Spain</b>	Completed transposition of EU CO <sub>2</sub> Storage Directive†	CIUDEN: a technological development institution created in 2006 by the Spanish Administration.
<b>Republic of Korea</b>	National CCS master plan sets a goal of two large-scale demonstrations by 2020; assessing needs for geologic storage-specific regulations†	CCS Test Programme (USD 648.4m)
<b>United Arab Emirates</b>	The emirate of Abu Dhabi is evaluating policy frameworks for a domestic CCS industry; targeting development of a CCS network linking CO <sub>2</sub> emitters to users for enhanced oil recovery by 2020.	
<b>United Kingdom</b>	Ban on combustion power stations larger than 300 MW that are not CCS-ready; ban on coal-fired power plants without CCS on at least 300 MW of output; proposed a long-term funding mechanism for low-carbon power (including CCS) through the Electricity Market Reforms; finalising implementation of EU CO <sub>2</sub> Storage Directive†	CCS Demonstration Competition (GBP 1bn)
<b>United States</b>	Two federal rules relating to geologic storage;† numerous states have or are developing laws and regulations on geologic storage†	Clean Coal Power Initiative (USD 1.7bn) FutureGen (USD 1.0bn) Industrial Carbon Capture and Storage (USD 1.43bn) Power Sector and Industrial Gasification Tax Credits (USD 3.15bn) Carbon Sequestration Tax Credit (USD 1.0bn)

\* Global CCS Institute’s Global Status of CCS 2011

† IEA CCS Legal and Regulatory Review, 2011

## Transport

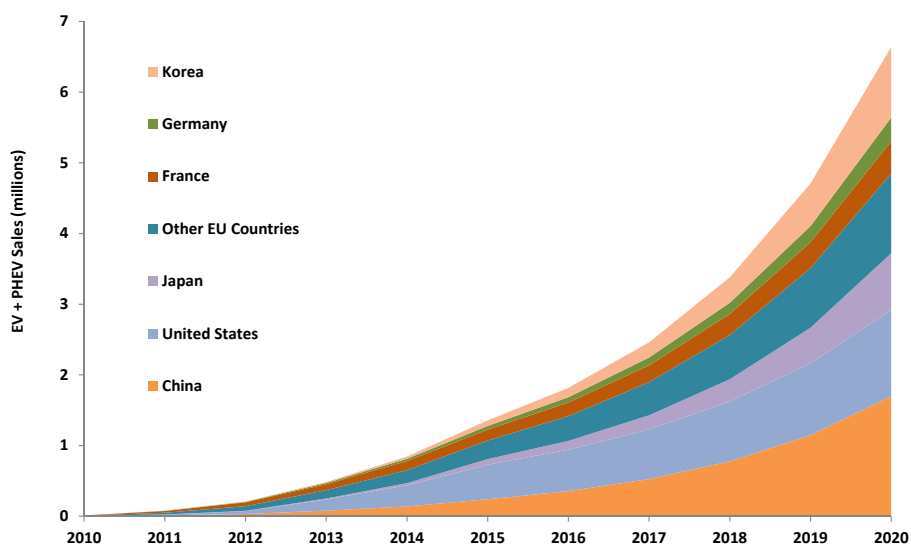
Transport accounts for about 27% of the world’s final energy use and 23% of energy-related CO<sub>2</sub> emissions, with 62% of all transport CO<sub>2</sub> coming from G-20 countries. This section provides an overview of the status and policies in place for G-20 countries in their shift towards an energy efficient and less carbon intensive transport sector, with a focus on three areas: uptake of electric and plug-in hybrid vehicles (EVs and PHEVs), light-duty vehicle fuel economy improvement, and adoption of biofuels.

### Electric vehicles

Many countries have set ambitious targets for introducing electric and plug-in hybrid vehicles over the next 10 years. Nearly all of those countries known to have set targets are in G-20 (either directly or via EU membership). Figure 10 shows that taken together, these targets reach seven million vehicle sales in 2020, with nearly 25 million cumulative over that period. While this would be a positive achievement, it would still only represent about 2% of the world vehicle fleet in 2020 and account for less than 1% of electricity demand. While the contribution of electric vehicles to GHG

emission reductions is heavily dependent on decarbonising electricity generation, deployment today is necessary to prepare the industry for larger-scale deployment post-2020, at which time reduced carbon intensity of electricity generation will indeed be important. Over the next decade battery storage capacities and durability must be improved, along with the deployment of sufficient charging infrastructure, for EVs to succeed.

**Figure 10** Aggregated G-20 member national targets for EV/PHEVs



Source: IEA Statistics and country submissions.

### Summary of G-20 policies

In order to achieve their own announced targets, it appears likely that governments will need to spend substantial sums in three areas: RD&D, infrastructure, and incentives for vehicle sales. Many governments have already launched programmes that commit to major expenditures. Several have, for example, put in place customer incentives that range from USD 5 000 to USD 7 500 per vehicle for each electric vehicle sold.

Table 10 below provides a summary of G-20 country targets and fiscal policies in support of EV deployment. Complete country submissions can be found in the document *Compendium of G-20 C3E Working Group Questionnaire Submissions*. In the case of EVs, many countries now have sales targets but the level of other support to achieve those targets varies significantly. Incentives and investments in infrastructure (and financing mechanisms for these activities) are needed in all countries seeking to introduce EVs. Further it will be important to ensure that manufacturers provide vehicles in numbers that align with the national targets – which currently does not appear to be the case.

Taking into account caps on subsidy programmes (that limit the total amount spent), current known programmes could result in total expenditures of around USD 20 billion over the next three to five years. However, total worldwide spending through 2020 could be far higher if incentive programmes continue, even if incentive levels decline over time. For example, if the average incentive were USD 5 000 per vehicle for the next ten years, total incentive spending for those vehicles would be USD 100 billion if 20 million vehicles are sold.

A separate IEA analysis of infrastructure requirements estimates that cumulative electric vehicle charging infrastructure could cost in the order of USD 8 billion over the next 10 years. This relates to roughly 960 household recharging stations and 20 public stations per 1 000 electric vehicles on the road in 2020.

**Table 10** Summary of G-20 country electric-vehicle policies

Country	Electric Vehicle Sales/stock targets	Fiscal Incentives	Other targets/data
Argentina			Renault-Nissan research deal
Australia			Electric vehicle trial funded through the Smart Grid, Smart City program that commenced early 2011. Current priorities are: <ul style="list-style-type: none"> <li>to examine market barriers to the broader adoption of electric and natural gas vehicles – to be conducted by the Australian Energy Market Commission (AEMC).</li> <li>to support electric vehicle demonstration projects to explore business models and integration with electricity / gas distribution networks.</li> </ul>
Brazil			Fiat Brazil to Produce and sell Electric Cars
Canada	Stock target of 0.5 million by 2018	5k to 8.5k per vehicle (for the first 10k units)	Vancouver is first North American city to link development rules to EV infrastructure
China	Stock target of 10 million hybrids, plug-in hybrids and EVs by 2020. About half expected to be plug-in vehicles	Maximum Yuan 60 000 (USD 9 100)per vehicle in pilot cities (total 1.76 billion by 2012)	Pilot programme for electric vehicles in five cities.
European Union	3.3 million EVs (CE Delft projection)	Electromobility initiative, Green eMotion, supported through EUR 41.8 million	Rules on the interoperability of charging infrastructure for clean vehicles.
France	Stock target of 2 million PHEVs/EVs by 2020	Incentive budget 560 million Tax credit through 2012. EUR 400 million	Government fleet commitment of 50 000 EVs
Germany	Stock target of 1 million PHEVs/EVs by 2020	Tax exemption through 2015	EUR 500 million EV infrastructure plan announced
India	Indian manufacturer Reva is aiming for 5 000 EVs in 2012	INR 100K (USD 2 200 ) per vehicle (total 840 vehicle to 2012)	VAT rates for EVs brought down in several states
Indonesia	Audi is aiming to produce 2 700 EVs for domestic market		First country in Southeast Asia to have the Smart Electric Drive
Italy	Specific target for EV unclear from submission	(For low CO <sub>2</sub> vehicle: EUR 1.5k to 4.5k /vehicle, EUR 0.3 to 0.5 billion)	400 charging points in Rome, Pisa and Milan
Japan	PHEV/EV sales target of 15% to 20% of total LDV sales in 2020	Incentive budget USD 300 million/year(2010)	2 million normal chargers and 5 000 quick chargers by 2020
Korea	1.2 million green cars(EV, PHEV, HEV, FCEV, CDV) by 2015		KRW 400 billion (USD 342.6 million) by 2014 on research and development for high-performance batteries and other related systems
Mexico			
Russia	Up to 100 thousand hybrid cars/ year (E-mobile)		Government backs production of hybrid cars with electric transmission
Saudi Arabia			
South Africa			Research centre established
Spain	Stock of 250 000 (EV/PHEV) by 2014 and 2 5M by 2020	EUR 6 000 per vehicle	Smart cities and smart grids research; MOVELE Demonstration Project and the Integral Strategy to Impulse the EV/PHEV in Spain 201014

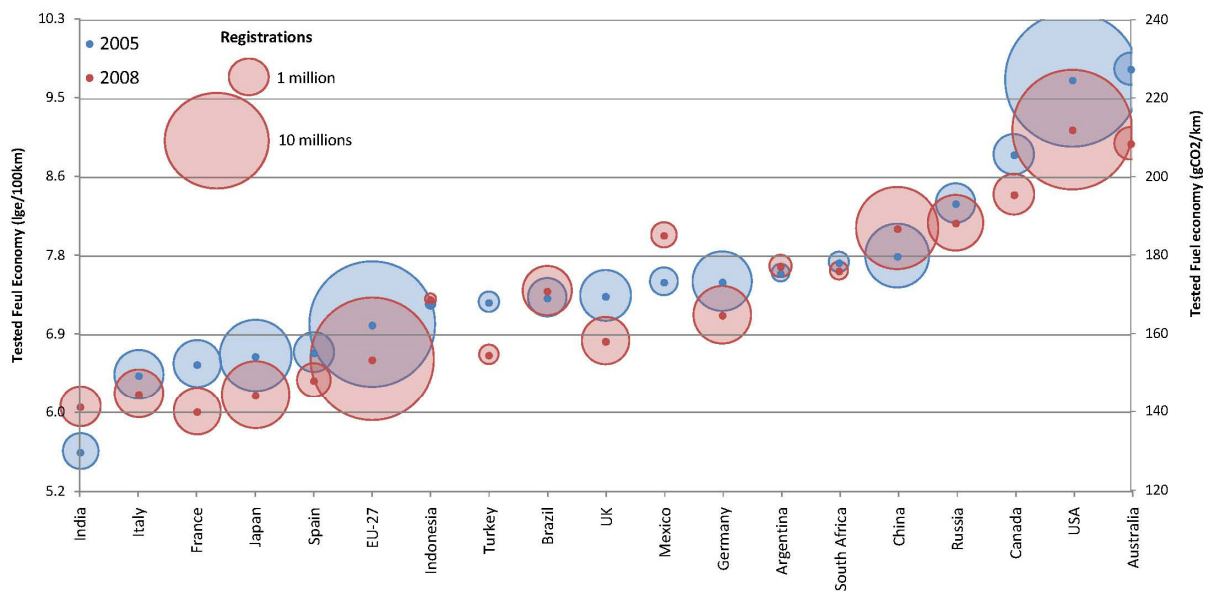
<b>Turkey</b>		Lowered tax rates for EVs	Domestic manufacturing started on EVs
<b>United Kingdom</b>		A customer incentive up to GBP 5 000 (equivalent USD 7 700) per ultra low emission vehicle	UK Government confirmed over GBP 400m to support incentive, infrastructure and R&D up to 2015. Mayor of London commitment for 25 000 charging points in London by 2015
<b>United States</b>	Stock target of 1 million by 2015	USD 7 500/vehicle	American Recovery and Reinvestment Act included USD 2.4 billion for battery and electric drive component manufacturing, and for electric drive demonstration and infrastructure investments

**Fuel economy improvement**

Fuel economy of internal combustion engine vehicles over the next ten years is also a priority for cutting fuel use and CO<sub>2</sub> emissions, and in fact if carried out to its potential, could cut fuel use and CO<sub>2</sub> emissions far more than electric vehicles over this time frame.

Figure 11 demonstrates that there is a wide range of current average new LDV fuel economy, with countries like France and India selling cars with the lowest fuel consumption per kilometre, while the United States and Australia are among the highest. The global average in 2005 was estimated to be about 8.1 litres per 100 km (about 29 MPG), improving to 7.7 by 2008 (31 MPG). However, while improvements were positive in many countries, others experienced a slight worsening of fuel economy.

**Figure 11** Global light-duty vehicle fuel economy

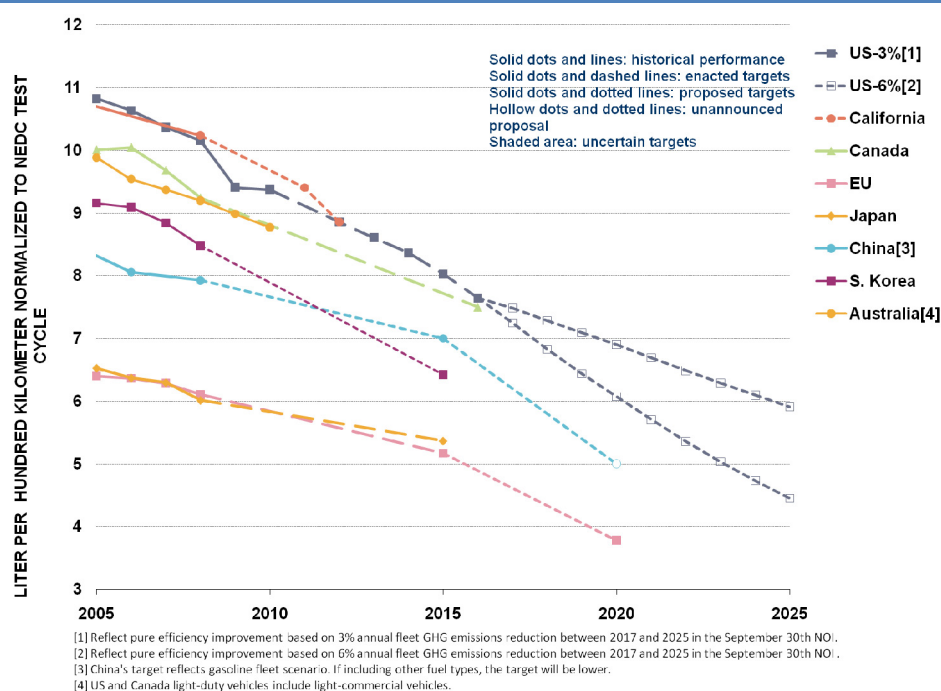


Source: Polk (2009), IEA analysis and country submissions.

**Summary of G-20 policies**

As shown in Figure 12, good progress is being made in a number of countries to improve fuel economy, with thanks to relatively strong enacted and announced fuel economy targets and standards. These efforts could however be expanded at a global level, and it will be important to continue strong improvements after 2015.

**Figure 12** Average fuel economy trends through 2008 by region, with enacted or proposed targets through 2020



Source: ICCT, 2011.

Table 11 shows the situation with fuel economy policies in G-20 countries, including standards and fiscal measures. Many countries do not have any significant policy at this point and for those that do, not all have strong fiscal measures to support standards. Fiscal measures could help send a market signal to consumers to purchase the more efficient vehicles that manufacturers are being asked to sell. Complete country submissions can be found in the document *Compendium of G-20 C3E Working Group Questionnaire Submissions*.

**Table 11** Summary of G-20 country fuel economy policies

Country	Fuel Economy Policies	Vehicle Fiscal Measures
Argentina		
Australia	The Green Vehicle Guide and the Fuel Consumption Label; Fuel quality regulated under the Fuel Quality Standards Act 2000. Mandatory carbon dioxide emissions standards for all new light vehicles sold in Australia. The mandatory standard will set a national target for average carbon dioxide emissions per kilometre driven.	
Brazil	Car labelling deployment	Registration tax based on engine size
Canada	Same as United States CAFE standards	
China	Has weight-class based LDV fuel economy standards; Has proposed tightening through 2020.	Registration and ownership taxes based on engine size.
European Union	EU has CO <sub>2</sub> regulations for passenger LDVs requiring 130 g/km maximum CO <sub>2</sub> levels by 2015; CO <sub>2</sub> standards for light commercial vans with a target 175 g/km.	Different taxation schemes, see below
France	Covered by EU regulations, also bonus-malus system on vehicle purchase with fees on high CO <sub>2</sub> emitters and rebates on very low CO <sub>2</sub> emitters. In the public administration, 88,6% of newly bought vehicles emit less than 130g of CO <sub>2</sub> per km.	Tax on new cars paid once dependent on CO <sub>2</sub> emission. Bonus/malus system. Emission targets by bonus/malus class are reduced by 5% each two years. Plus tax dependent on power to be paid once when registering the car.

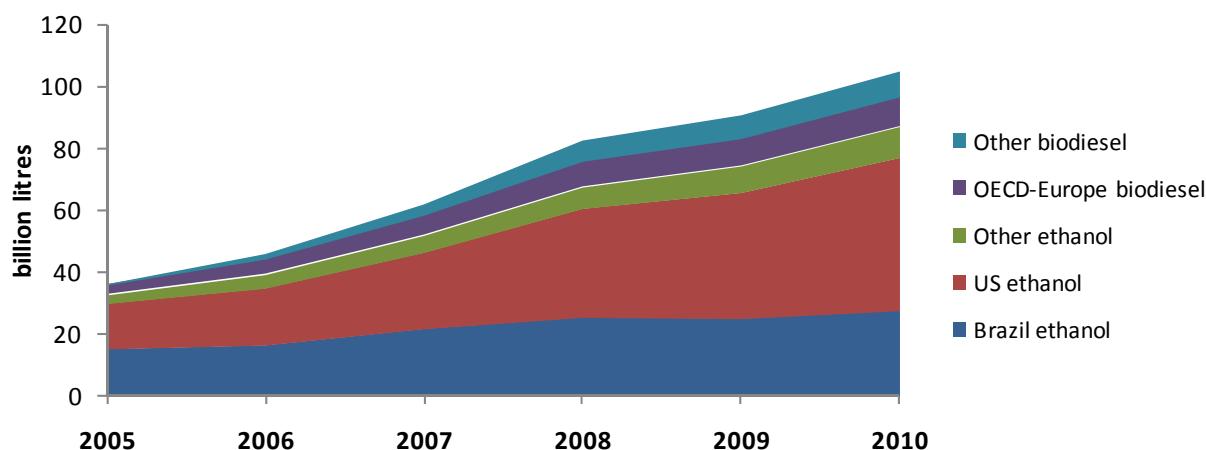
<b>Germany</b>	Covered by EU regulations; also vehicle annual registration tax system based on emissions. Car labelling scheme revised in August 2011.	Annual tax dependent on motor volume, energy source (gasoline vs. diesel, CNG, LPG), emission standard, vehicle type (passenger vs freight) and CO <sub>2</sub> emission. No additional CO <sub>2</sub> tax up to 120gCO <sub>2</sub> /km.
<b>India</b>	Fuel economy standards in development	Tax scheme based on vehicle classes and engine size.
<b>Indonesia</b>		
<b>Italy</b>	Covered by EU regulations	Annual tax dependent on engine power: EUR 2.50/kW.
<b>Japan</b>	"Top Runner" LDV fuel economy standards and heavy truck standards in place; periodically tightened.	Engine size and weight based tax. Tax deductions based on fuel economy are also available.
<b>Korea</b>	Fuel economy standards in place. A scheme aligned with EU and United States standards to be introduced from 2012; 140 gCO <sub>2</sub> /km by 2015. Heavy duty regulation from 2013. Labelling for Tyres	Incentives are available for low CO <sub>2</sub> emission vehicles.
<b>Mexico</b>	Fuel economy standards in development	
<b>Russia</b>	Under consideration	Annually tax dependent on engine power and region. From 2011 on, furthermore dependent on emission standard, up to 60% more for EUR 27. Progressive increase above 100hp.
<b>Saudi Arabia</b>		
<b>South Africa</b>	No information	Annual tax dependent on weight
<b>Spain</b>	Covered by EU regulations	Vehicle sales tax modified to reflect CO <sub>2</sub> emissions (<120g/km have zero tax).
<b>Turkey</b>	No information	Annual tax dependent on vehicle type (PC, CV, bus), age and volume of engine. The older the vehicle the lower the tax.
<b>United Kingdom</b>	Covered by EU regulations. A fuel efficiency labelling scheme has been introduced for both new and used cars and a CO <sub>2</sub> -based annual car tax system is also in place.	Annual vehicle tax rates (Vehicle Excise Duty) for cars are split into 13 bands depending on CO <sub>2</sub> emissions.
<b>United States</b>	In 2010 set revised CAFE standards for LDVs to approximately 34.1 mpg by 2016. Fuel economy standards for heavy-duty vehicles in development.	Gas-guzzler-tax for less fuel-efficient passenger vehicles.

## Biofuels

While biofuels have been produced commercially in both the United States and Brazil for several decades, the sector has seen its fastest growth rate during the last ten years. Driven by policy support in more than 50 countries, including a range of G-20 countries, global biofuels production grew from 16 billion litres in 2000 to more than 100 billion litres in 2010 (Figure 13). According to 2009 IEA data, biofuels in account of as much as 21% of all transport fuel in Brazil; in the United States its share is 4% and in the European Union it is around 3%.



Figure 13 Global biofuels production by type of fuel, 2005-10



Source: IEA Statistics.

Even though the sector witnessed a rapid growth over the last 10 years, high feedstock prices, overcapacity and public discussion on the sustainability of biofuels have recently slowed down growth. This may limit the future expansion potential of fuels that rely on comparably costly feedstock, whereas the production of conventional biofuels such as sugarcane, which generally perform well in terms of land-use efficiency, lifecycle-GHG savings and production costs, is expected to continue its growth also in the long-term.

Installed advanced biofuel capacity (e.g. ligno-cellulosic ethanol, advanced biodiesel, biomass-to-liquids and other types) today is roughly 175 million litres gasoline equivalent (lge)/year, but most plants are currently operating below nameplate capacity. Another 1.9 billion lge/year production capacity are currently under construction. In addition, project proposals for an additional 6 billion lge annual capacity by 2015 have been announced. The advanced biofuel production units currently operating, are mainly pilot- and demonstration facilities with fuel production volumes of less than 10 million litres per year. Over the next 5 years a number of projects with considerably larger production volumes are expected to become operational, thus reaching similar output level as commercial-scale conventional biofuel plants. However, certain advanced biofuels (e.g. biomass-to-liquids) will likely require larger output volumes to reach economy of scale.

### Summary of G-20 policies

The growth in global biofuel production over the last 10 years has mainly been driven by support policies. The key motivation has varied between countries – energy diversity and security improvements, reduction of greenhouse-gas emissions or support to the rural and agricultural sector with different emphasis given to each motivation in each market.

The principal policy tools which have been used to stimulate demand for biofuels are blending mandates, often coupled with fuel duty rebates. Mandates are now in place in nearly 50 countries (IEA, 2011)<sup>5</sup>, including many G-20 countries (Table 12). Such measures have successfully stimulated demand in most countries and states where they have been employed, but effectively implementing mandates might require legal backup through sanctions for non-compliance.

Policies have been developed and adapted to take into account concerns about the sustainability of some conventional biofuels options as discussed above. Analysis on these complex issues, and particularly on emissions associated with direct and indirect land-use change, where no consensus has been reached, has been evolving rapidly over the past five years. At global level, the Global

<sup>5</sup> The IEA Biofuel Roadmap includes an overview table with all biofuel policies.

Bioenergy Partnership (GBEP) has agreed on a list of 24 sustainability indicators for biofuels and bioenergy in May 2011 and will now continue its work on capacity building for the pilot testing of those indicators among partners and observers in GBEP.

Some countries have adopted mandatory sustainability requirements for biofuels, in order to be counted against blending targets. In addition, policy mechanisms that address the investment risk of developing commercial-scale advanced biofuel production units, such as loan guarantees and other financing mechanisms have been introduced in some G-20 countries. The key policy challenge in the biofuel sector will be to enforce sound sustainability requirements for biofuels, while at the same time providing a stable, long-term policy framework that enables industry to invest with confidence.

Table 12 provides a summary of biofuels-related policies in G-20 countries. Complete country submissions can be found in the document *Compendium of G-20 C3E Working Group Questionnaire Submissions*.

**Table 12** Summary of G-20 country biofuels policies

G-20 countries	Current	Financial support	Other support policy
<b>Argentina</b>	Resolution No. 828/10: mandatory biodiesel blending of 7% as of 2011. Possibilities to extend it to 10%. B5 mandate		Law N° 26.093, ruled by decree N° 109/07 – Policy framework
<b>Australia</b>	NSW: E10 to replace regular (91 RON) unleaded petrol from July 2012; B5 from January 2012	The Cleaner Fuels Grants Scheme fully offsets any excise duty or customs duty payable in relation to the manufacture or importation of biodiesel.  The Ethanol Production Grant reimburses producers for the value of excise paid on domestically produced ethanol.	
<b>Brazil</b>	B5 (5% mandatory blending) in 2013 (anticipated to 2010)  Ethanol mandate: E18 to E25 (legislation establishes 18% to 25% mandatory anhydrous ethanol blending with gasoline, since 1980) and E100 (hydrated ethanol) available to be used in flex fuel vehicles since 2003.  Ethanol: 64 billion liters by 2019 (PDE 2019)  Biodiesel: 4.2 billion liters by 2019 (PDE 2019)	<b>Financial support:</b> Brazilian biofuel policy	National Programme for the Production and Use of biodiesel  <b>Social Fuel Certificate:</b> a certificate, which allows for fiscal incentives, is attributed as recognition to producers' contribution to social inclusion in agriculture.  The Sugarcane Agroecological Zoning (ZAE)
<b>Canada</b>	<b>Renewable Fuels Regulations:</b> require an average renewable fuel content of 5% in gasoline starting 15 December 2010  Requirement for an average 2% renewable content in the national diesel fuel and heating oil pool starts 1 July, 2011 (31 December, 2012 in some regions)	<b>Production/sales volume operating incentives :</b> ecoENERGY for Biofuels Programme  <b>Repayable Contributions:</b> ecoAgriculture Biofuels Capital Initiative  <b>Direct Investments:</b> NextGen Biofuels Fund™  <b>RD&amp;D grants:</b> ecoENERGY Innovation Initiative	<b>Framework policy:</b> Renewable Fuels Strategy  <b>Information and research:</b> ecoTECHNOLOGY for Vehicles  <b>GHG Emission Standards:</b> Reducing Greenhouse Gas Emissions from New Cars and Light Trucks
<b>China</b>	E10 by 2020	<b>Tax policy and grants:</b> Ethanol programme	

<b>European Union</b>	<p>Directive 2009/28/EC: 10% share of energy from renewable sources in the transport sector by 2020</p> <p>2011 White Paper: 2050: 60% reduction of GHG emissions from transport relative to 1990</p> <p>Decision 406/2009/EC – Target 10% GHG emission reduction from the covered sectors</p>	<p>Decision 406/2009/EC – Decision on the effort of Member States to reduce their GHG emissions to meet the Community's greenhouse gas emission reduction commitments up to 2020 in sectors not covered by the 2003/87/EC such as such as transport, buildings, agriculture and waste</p>	<p>2011 White Paper: Roadmap to a Single European Transport Area</p>
<b>France</b>	<p>E5-E10 (2009); E85 (2007) B7 (2008); B30 (2007)</p> <p>10% share of transport fuel from renewable by 2020, in line with Directive 2009/28/EC</p>	<p><b>Tax Policy and other financial incentives:</b> a tax exemption for operators blending biofuels in regular fuel under condition that these biofuels are produced in an approved production unit – an additional tax for oil operators who are putting fuel on the market and who don't reach the minimal threshold of incorporated biofuel (7% in 2011).</p>	<p><b>Framework policy:</b> Le Grenelle de l'environnement</p> <p>National System of sustainability certification for biofuels</p>
<b>Germany</b>	<p>10% share of transport fuel from renewable by 2020, in line with Directive 2009/28/EC</p>		<p><b>Sustainability standard:</b> Biofuels Sustainability Ordinance (2009)</p> <p>Implementation of the sustainability requirements of the Directive on the Promotion of the Use of Renewable Energy Sources 2009/28/EC</p>
<b>India</b>	<p>National Bio-Fuel Policy 2009</p> <p>5% bio-fuel blending in Diesel and Petrol</p>	<p>Ministry of Petroleum &amp; Natural Gas notification of 2009 for minimum bio-fuel price</p>	<p>Oil Marketing Companies have achieved contracts for 2.5% blending of ethanol in Petrol.</p> <p>Blending in Diesel has not taken off so far</p>
<b>Indonesia</b>	<p>Biofuel Roadmap: Biodiesel and bioethanol blending mandates from 2006 (B10;E5) to 2025 (B20; E15) and Special Biofuel Zones</p>	<p><b>Tax policy and financial support:</b> Biofuel decree</p>	
<b>Italy</b>	<p>10% share of transport fuel from renewable by 2020, in line with Directive 2009/28/EC</p>	<p><b>Tax policy:</b> Fiscal rebate (reduced excise tax on biodiesel)</p>	<p><b>Certification:</b> National System of sustainability certification for biofuels</p>
<b>Japan</b>		<p><b>Grants and assessment for E3 mandate:</b> Research Biofuel Programme</p>	<p><b>Framework policy:</b> Comprehensive review of Japanese energy policy</p>
<b>Mexico</b>		<p><b>Subsidies :</b> The Law on the Promotion and Development of Biofuels (LPDB)</p>	
<b>Republic of Korea</b>			<p><b>Feasibility assessment programme:</b> Biofuels</p>
<b>Russia</b>	<p>4.5% share of Renewable Energy in Energy balance</p>		<p><b>Framework policy :</b>The national ES and EE programme approved by the regulation of the government of the RF # 2446-p as of 27 December 2010</p>
<b>South Africa</b>			<p><b>Framework policy:</b> White paper on renewable energy</p>

<b>Spain</b>	10% share of transport fuel from renewable by 2020, in line with Directive 2009/28/EC	Tax exemption to biofuels	<p><b>Mandatory biofuels requirement:</b> The amendment to the Spanish Hydrocarbons Law 12/2007 2 July:</p> <ul style="list-style-type: none"> <li>• Order ITC/2877/2008: Use mandate.</li> <li>• Biofuels certificate system: standard</li> <li>• Circular 2/2009 from the National Commission of Energy: Enforcement regulation</li> </ul>
<b>Turkey</b>			<b>Framework Policy:</b> Strategic Plan 2010
<b>UAE</b>	5% renewable energy in the fuel mix by 2030		Masdar demonstration project
<b>United Kingdom</b>	The Renewable Transport Fuels Obligation (RTFO): obligates fossil fuel suppliers that a specified percentage of their fuels for road transport in the United Kingdom comes from renewable sources. The obligation increases annually from 2.5% in 2008/9 to a level of 5% in 2013/14. 10% share of transport fuel from renewable by 2020, in line with Directive 2009/28/EC	<p><b>Tax Policy:</b> Preferential Tax regime for all biofuels, expired in 2010, and for biofuel from used cooking oil, due to expire in 2012.</p> <p><b>Quota policy:</b> The Renewable Transport Fuels Obligation (RTFO)</p>	<b>Framework policy:</b> Renewable Energy White Paper
<b>United States</b>	48 billion litres of which 0.02 cellulosic-ethanol; 78 bln L in 2015, of which 11.4 bln L cellulosic; 136 bln L in 2022, of which 60 bln L cellulosic ethanol	<p><b>Tax policy:</b> Cellulosic Biofuel Producer Tax Credit; Alternative Motor Vehicle Credit; Qualified Alternative Fuel Motor Vehicle (QAFMV) Tax Credit; Light-Duty Hybrid Electric Vehicle (HEV) and Advanced Lean Burn Vehicle Tax Credit; Fuel Cell Motor Vehicle Tax Credit; Alternative Fuel Infrastructure Tax Credit; Alternative Fuel Tax Exemption</p> <p><b>Grants:</b> Renewable Fuel Infrastructure Grants</p>	<p><b>Technology demonstration:</b> Advanced Biofuels Process Development Unit (PDU); Biomass program</p> <p><b>Education:</b> National Biodiesel Education Program</p>

## Annex 1. C3E Working Group questionnaire

### PART 1A: ENERGY EFFICIENCY<sup>6</sup>

<b>COUNTRY:</b>			
<b>SECTOR</b>	<b>TARGETS INCLUDED IN CURRENT NATIONAL LEGISLATION</b>	<b>POLICY FRAMEWORKS AND NATIONAL PRIORITIES</b>	<b>CURRENT PROGRESS</b>
Buildings			
Appliances and Equipment			
Lighting			
Transport			
Industry			
Cross sectoral			
Others			

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<sup>6</sup> Member countries to the G-20 C3E Working Group were requested to use this questionnaire as a guideline, but were invited to submit policy information in the format that most suited their needs. The *'Compendium of G-20 C3E Working Group Questionnaire Submissions'* contains all individual country submissions in the form that they were shared with the Working Group.

PART 1B: CLEAN ENERGY

<b>COUNTRY:</b>			
<b>SECTOR</b>	<b>TARGETS INCLUDED IN CURRENT NATIONAL LEGISLATION</b>	<b>POLICY FRAMEWORKS AND NATIONAL PRIORITIES</b>	<b>CURRENT PROGRESS</b>
<b>POWER GENERATION</b>			
Wind power			
Solar			
Hydropower			
Biomass			
Geothermal			
Marine power			
Carbon Capture and Storage			
Nuclear			
Cross sectoral			
Others			
<b>TRANSPORTATION SECTOR</b>			
Biofuels			
Electric vehicles			
Cross sectoral			
Others			
<b>COOLING AND HEATING</b>			
Solar			
Biomass			
Geothermal			
Cross sectoral			
Others			

# Acronyms, abbreviations and units of measure

## Acronyms

BAT	Best Available Technology
C3E	Clean Energy and Energy Efficiency
CCS	carbon capture and storage
CFLs	compact fluorescent light bulbs
DIS	Draft International Standard
ECF	Energy and Climate Fund
EOR	Enhanced Oil Recovery, US
EV	electric vehicle
G-20	Includes member countries to the G-20 process
GBEP	Global Bioenergy Partnership
GCCSI	Global Carbon Capture and Storage Institute
IEA	International Energy Agency
ISO	International Standards Organisation
MEPS	minimum energy performance standards
OPEC	Organisation of the Petroleum Exporting Countries
PHEV	plug-in hybrid vehicle
PV	photovoltaic
S&L	standards and labelling
UAE	United Arab Emirates

## Abbreviations

CO <sub>2</sub>	carbon dioxide
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## Units of measure

Gt	gigatonne
GW	gigawatt
GWth	gigawatt thermal capacity
km	kilometre
kWh	kilowatt-hour
lge	litres gasoline equivalent
m <sup>2</sup>	square metre
MPG	miles per gallon
Mtoe	million tonne of oil equivalent
MWh	megawatt-hour
TWh	terawatt-hour

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