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# WHO'S WINNING THE CLEAN ENERGY RACE?

Growth, Competition and Opportunity  
in the World's Largest Economies



G-20 CLEAN ENERGY FACTBOOK



## THE PEW CHARITABLE TRUSTS

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## THE PEW ENVIRONMENT GROUP

The Pew Environment Group promotes practical, meaningful solutions to some of the world's most pressing environmental problems.

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## ABOUT THE REPORT

The Pew Charitable Trusts' *Who's Winning the Clean Energy Race?* was developed for public informational and educational purposes. It reviews the status of clean energy finance and investment in the countries that make up the Group of Twenty (G-20).<sup>1</sup> This report complements *The Clean Energy Economy: Repowering Jobs, Businesses and Investments Across America*, produced by the Pew Environment Group and the Pew Center on the States in June 2009.

The underlying data for this report were compiled for the Pew Environment Group by Bloomberg New Energy Finance, the world's leading provider of news, data and analysis on clean energy and carbon market finance and investment. Bloomberg New Energy Finance's global network of 125 analysts stationed across Europe, the Americas, Asia and Africa continuously monitor market changes, deal flow and financial activity, allowing instantaneous transparency into the clean energy and carbon markets.

A description of the data collection methods and practices employed for this report can be found in the appendix.

## ACKNOWLEDGMENTS

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We also thank staff members of the Pew Center on the States for their insights, advice and guidance at critical stages of this project. We are especially grateful to Kil Huh and Lori Grange for generously sharing their ideas and suggestions. While they have screened the report for accuracy, the Pew Environment Group is responsible for its findings and conclusions.

<sup>1</sup> The Group of Twenty (G-20) was established in 1999 to bring together systemically important industrialized and developing economies to discuss key issues in the global economy. The G-20 is made up of the finance ministers and central bank governors representing the European Union and 19 countries: Argentina, Australia, Brazil, Canada, China, France, Germany, India, Indonesia, Italy, Japan, Mexico, Russia, Saudi Arabia, South Africa, South Korea, Turkey, the United Kingdom and the United States.

## TABLE OF CONTENTS

<b>EXECUTIVE SUMMARY .....</b>	<b>4</b>
<b>THE EMERGING CLEAN ENERGY ECONOMY .....</b>	<b>6</b>
Global Investments in Clean Energy Are Growing .....	6
Global and G-20 Clean Energy Investment, 2005 to 2009 .....	7
China Takes the Lead, While the U.S. Slips.....	7
Domestic Policy Choices Play a Critical Role.....	10
Wind and Solar Lead Investments .....	10
Asset Financing Dominates.....	11
Renewable Capacity Growing Worldwide .....	11
Governments Allocate Stimulus Funds to Clean Energy.....	11
About the Investment Data .....	12
<b>THE GLOBAL CLEAN ENERGY ECONOMY AT A GLANCE .....</b>	<b>14</b>
Overall .....	14
Competitiveness Snapshots of G-20 Members .....	14
Asset Financing Dominates.....	16
Public Market Financing .....	17
Venture Capital/Private Equity Financing .....	18
Installed Renewable Energy Capacity .....	19
G-20 Stimulus Funding for Clean Energy .....	20
<b>G-20 COUNTRY PROFILES.....</b>	<b>21</b>
Argentina .....	22
Australia.....	23
Brazil .....	24
Canada.....	25
China .....	26
France.....	27
Germany.....	28
India .....	29
Indonesia .....	30
Italy.....	31

Japan .....	32
Mexico.....	33
South Africa.....	34
South Korea.....	35
Spain.....	36
Turkey .....	37
United Kingdom.....	38
United States.....	39
Rest of EU-27 .....	40

## **APPENDIX: METHODOLOGY ..... 41**

### **TABLE OF FIGURES**

Figure 1. Financial Investment in Clean Energy: Global Trends by Quarter .....	6
Figure 2. Top 10 in Total Installed Capacity.....	7
Figure 3. Top 10 in Increase in Installed Capacity.....	7
Figure 4. Top 10 in Overall Clean Energy Investment .....	7
Figure 5. Five-Year Growth in Rate of Investment.....	7
Figure 6. G-20 Members' Investment in Clean Energy and Their Rank .....	8
Figure 7. Top 10 in Investment Intensity.....	10
Figure 8. Sustainable Energy Financing Continuum .....	13
Figure 9. Investment by Financing Type, 2009.....	15
Figure 10. Investment by Sector, 2009 .....	15
Figure 11. Asset Finance by Sector, 2004-09 .....	16
Figure 12. Asset Finance by Sector, 2009.....	16
Figure 13. Public Market Investment by Sector, 2004-2009 .....	17
Figure 14. Public Market Investment by Sector, 2009 .....	17
Figure 15. Venture Capital/Private Equity Financing by Sector, 2004-09 .....	18
Figure 16. Venture Capital/Private Equity Financing, 2009 .....	18
Figure 17. Installed Renewable Energy Capacity: Wind, Biomass and Waste, and Small Hydro.....	19
Figure 18. Installed Renewable Energy Capacity: Solar, Geothermal and Marine.....	19
Figure 19. Stimulus Funding.....	20

## Executive Summary

This report documents the dawning of a new worldwide industry—clean energy—which has experienced investment growth of 230 percent since 2005. Demonstrating its strength, the clean energy sector declined only 6.6 percent in 2009 despite the worst financial downturn in over half a century. In 2009, \$162 billion was invested in clean energy around the world. Rebounding from a sharp downturn in the last quarter of 2008 and first quarter of 2009, clean energy investments in the G-20 averaged a robust \$32 billion in each of the last three quarters of 2009. In an encouraging sign for the future, many governments prioritized clean energy within economic recovery funding, the bulk of which will reach innovators, businesses and installers in 2010 and 2011. Clean energy investments are forecast to grow by 25 percent to \$200 billion in 2010.

Accounting for more than 90 percent of worldwide finance and investment, G-20 countries dominate the clean energy landscape. As the country profiles in this report demonstrate, virtually all G-20 countries have seen investments grow by more than 50 percent over the last five years.

Within the G-20, our research finds that domestic policy decisions impact the competitive positions of member countries. Those nations—such as China, Brazil, the United Kingdom, Germany and Spain—with strong, national policies aimed at reducing global warming pollution and incentivizing the use of renewable energy are establishing stronger competitive positions in the clean energy economy. Nations seeking to compete effectively for clean energy jobs and manufacturing would do well to evaluate the array of policy mechanisms that can be employed to stimulate clean energy investment. China, for example, has set ambitious targets for wind, biomass and solar energy and, for the first time, took the top spot within the G-20 and globally for overall clean energy finance and investment in 2009. The United States slipped to second place.

There are reasons to be concerned about America's competitive position in the clean energy marketplace.

Relative to the size of its economy, the United States' clean energy finance and investments lag behind many of its G-20 partners. For example, in relative terms, Spain invested five times more than the United States last year, and China, Brazil and the United Kingdom invested three times more. In all, 10 G-20 members devoted a greater percentage of gross domestic product to clean energy than the United States in 2009. Finally, the United States is on the verge of losing its leadership position in installed renewable energy capacity, with China surging in the last several years to a virtual tie.

The U.S. policy framework for reducing global warming pollution and promoting renewable energy remains uncertain, with comprehensive legislation stalled in Congress. On the other hand, America's entrepreneurial traditions and strengths in innovation—especially its leadership in venture capital investing—are considerable, giving it the potential to recoup leadership and market share in the future.

Policy, investment and business experts alike have noted that the clean energy economy is emerging as one of the great global economic and environmental opportunities of the 21<sup>st</sup> century. Local, state and national leaders in the United States and around the world increasingly recognize that safe, reliable, clean energy—solar, wind, bioenergy and energy efficiency—can be harnessed to create jobs and businesses, reduce dependence on foreign energy sources, enhance national security and reduce global warming pollution.

Nations seeking to compete effectively for clean energy jobs and manufacturing would do well to evaluate the array of policy mechanisms that can be employed to stimulate clean energy investment. This is especially true for policymakers in the United States, which is at risk of falling further behind its G-20 competitors in the coming years unless it adopts a strong national policy framework to spur more robust clean energy investment.

# The Emerging Clean Energy Economy

## GLOBAL INVESTMENTS IN CLEAN ENERGY ARE GROWING

A new worldwide industry is dawning. Pew found that overall investment in clean energy grew 230 percent from 2005 to 2009. In 2009, \$162 billion was invested globally.<sup>2</sup> In the face of the world economic downturn, 2009 investments

declined only 6.6 percent from the year before. Demonstrating its staying power, the clean energy sector outperformed the oil and gas industry, which had investment declines of 19 percent in 2009, according to the International Energy Agency's 2009 *World Energy Outlook*.

FIGURE 1. FINANCIAL INVESTMENT IN CLEAN ENERGY: GLOBAL TRENDS BY QUARTER (billions of \$)

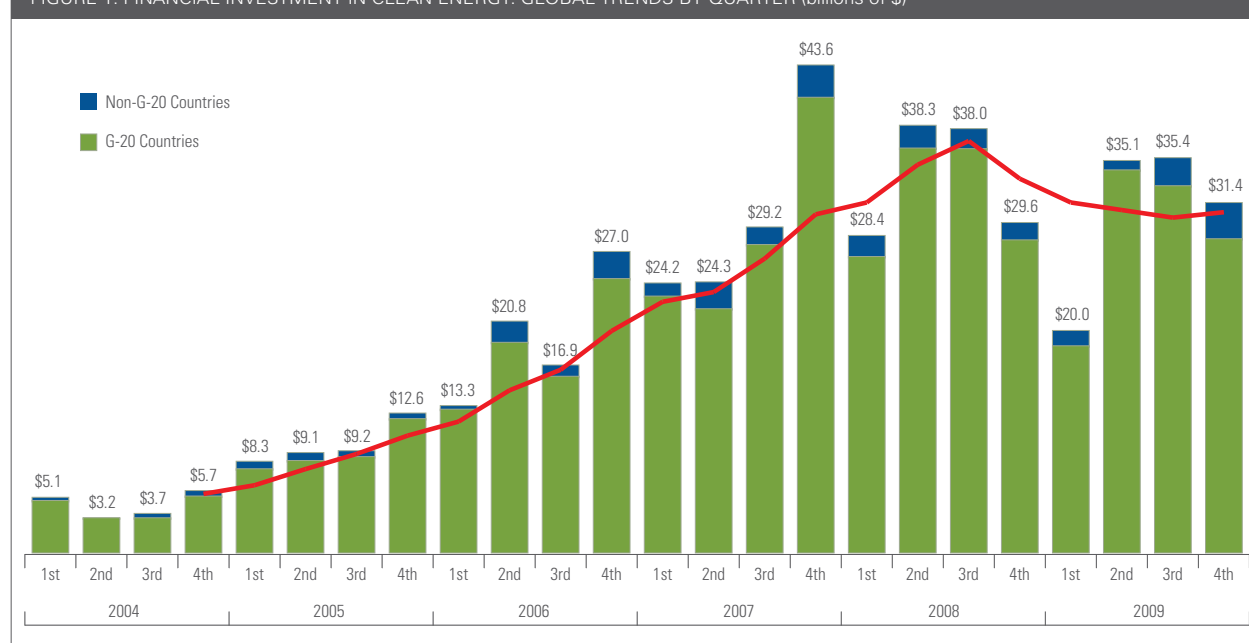


FIGURE 2. TOP 10 IN RENEWABLE ENERGY CAPACITY (GW)

United States	53.4
China	52.5
Germany	36.2
Spain	22.4
India	16.5
Japan	12.9
Rest of EU-27	12.3
Italy	9.8
France	9.4
Brazil	9.1

FIGURE 3. TOP 10 IN FIVE-YEAR GROWTH IN INSTALLED CAPACITY

South Korea	249%
China	79%
Australia	40%
France	31%
India	31%
United Kingdom	30%
Turkey	30%
United States	24%
Canada	18%
Rest of EU-27	17%

### Investment to Rise 25 Percent

The ongoing priority for energy security, global warming pollution reduction and job creation will drive investment up 25 percent to a record \$200 billion in 2010, Bloomberg New Energy Finance forecasts.

<sup>2</sup> All monetary values are 2009 U.S. dollars unless otherwise noted.



## GLOBAL AND G-20 CLEAN ENERGY INVESTMENT, 2005 TO 2009

Installed renewable energy capacity increased in 2009 to 250 gigawatts (GW), enough to power an estimated 75 million households and equivalent to 6 percent of the worldwide total.

G-20 nations account for more than 90 percent of worldwide finance and investment, dominating the clean energy landscape. Excluding basic research and development (R&D), more than \$110 billion was invested in the G-20's clean energy sector. Investment by virtually all G-20 countries has grown by more than 50 percent over the past five years. Rebounding from a sharp downturn in late 2008 and early 2009, clean energy investments in the G-20 averaged a robust \$32 billion in each of the last three quarters of 2009.

In an encouraging sign for the future, many governments prioritized clean energy within economic recovery funding, devoting more than \$184 billion of public stimulus investments to the sector. The true impact of that support is still to come, with the bulk of the funds reaching innovators, businesses and installers in 2010 and 2011.

## CHINA TAKES THE LEAD, WHILE THE U.S. SLIPS

China is emerging as the world's clean energy powerhouse. For the first time, China took the top spot for overall clean energy finance and investment in 2009, pushing the United States into second place. Having built a strong manufacturing base and export markets, China is working now to meet domestic demand by installing substantial new clean energy-generating capacity to meet ambitious renewable energy targets.

The United States ranked second in G-20 clean energy investments for the first time in five years. U.S. clean energy investments also fell 40 percent, compared with the previous year. Further declines were avoided through long-term extension of federal production and investment tax credits and initial funding from the American Recovery and Reinvestment Act, which helped to shore up investments in the latter half of 2009. Despite this influx of investment, there are reasons to be concerned about the U.S. competitive position in the clean energy marketplace.

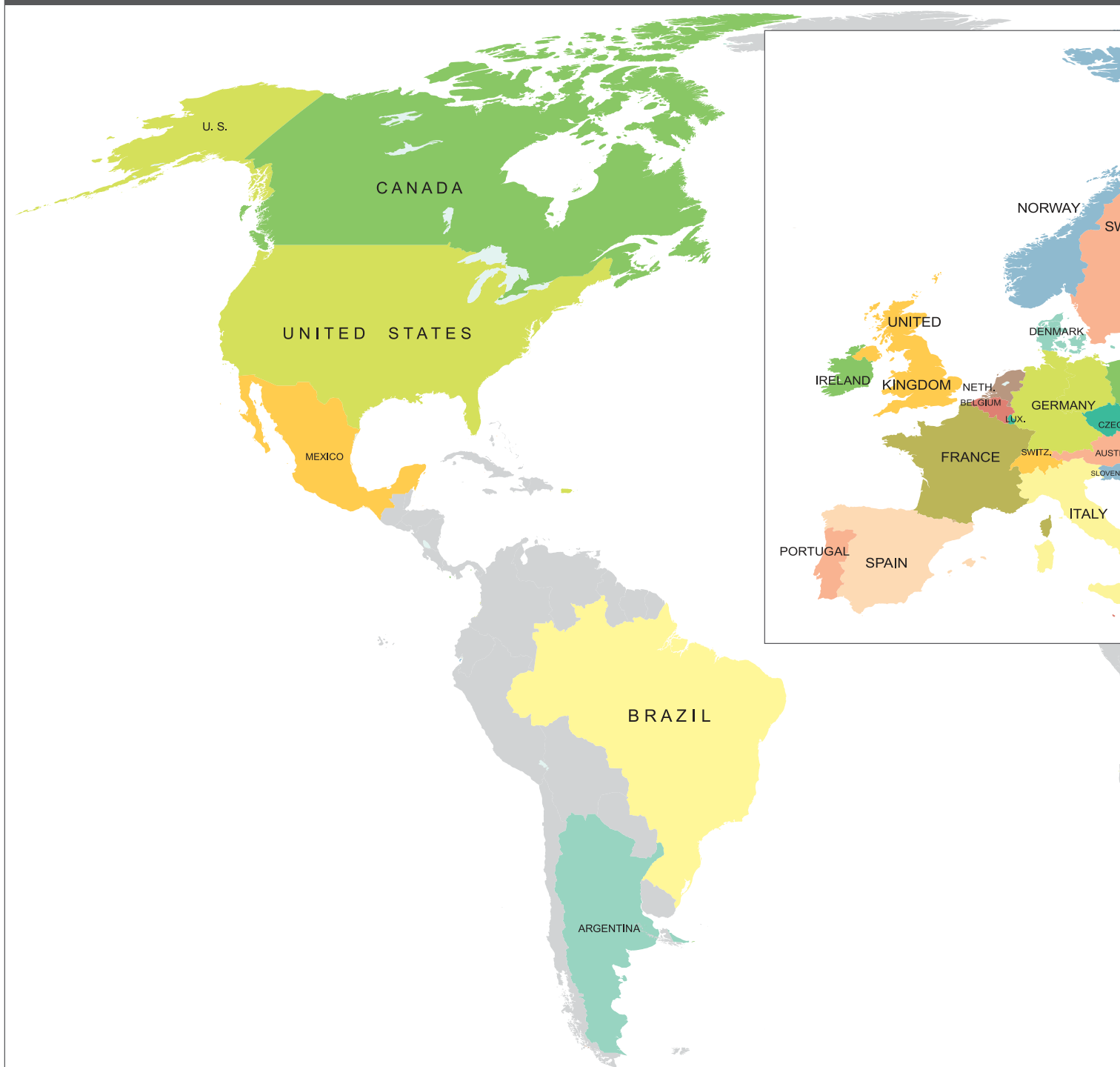
FIGURE 4. TOP 10 IN CLEAN ENERGY INVESTMENT

China	\$34.6 billion
United States	\$18.6 billion
United Kingdom	\$11.2 billion
Rest of EU-27	\$10.8 billion
Spain	\$10.4 billion
Brazil	\$7.4 billion
Germany	\$4.3 billion
Canada	\$3.3 billion
Italy	\$2.6 billion
India	\$2.3 billion

FIGURE 5. FIVE-YEAR GROWTH IN INVESTMENT

Turkey	178%
Brazil	148%
China	148%
United Kingdom	127%
Italy	111%
United States	103%
France	98%
Indonesia	95%
Mexico	92%
Rest of EU-27	87%

FIGURE 6. G-20 MEMBERS' INVESTMENT IN CLEAN ENERGY AND THEIR RANK



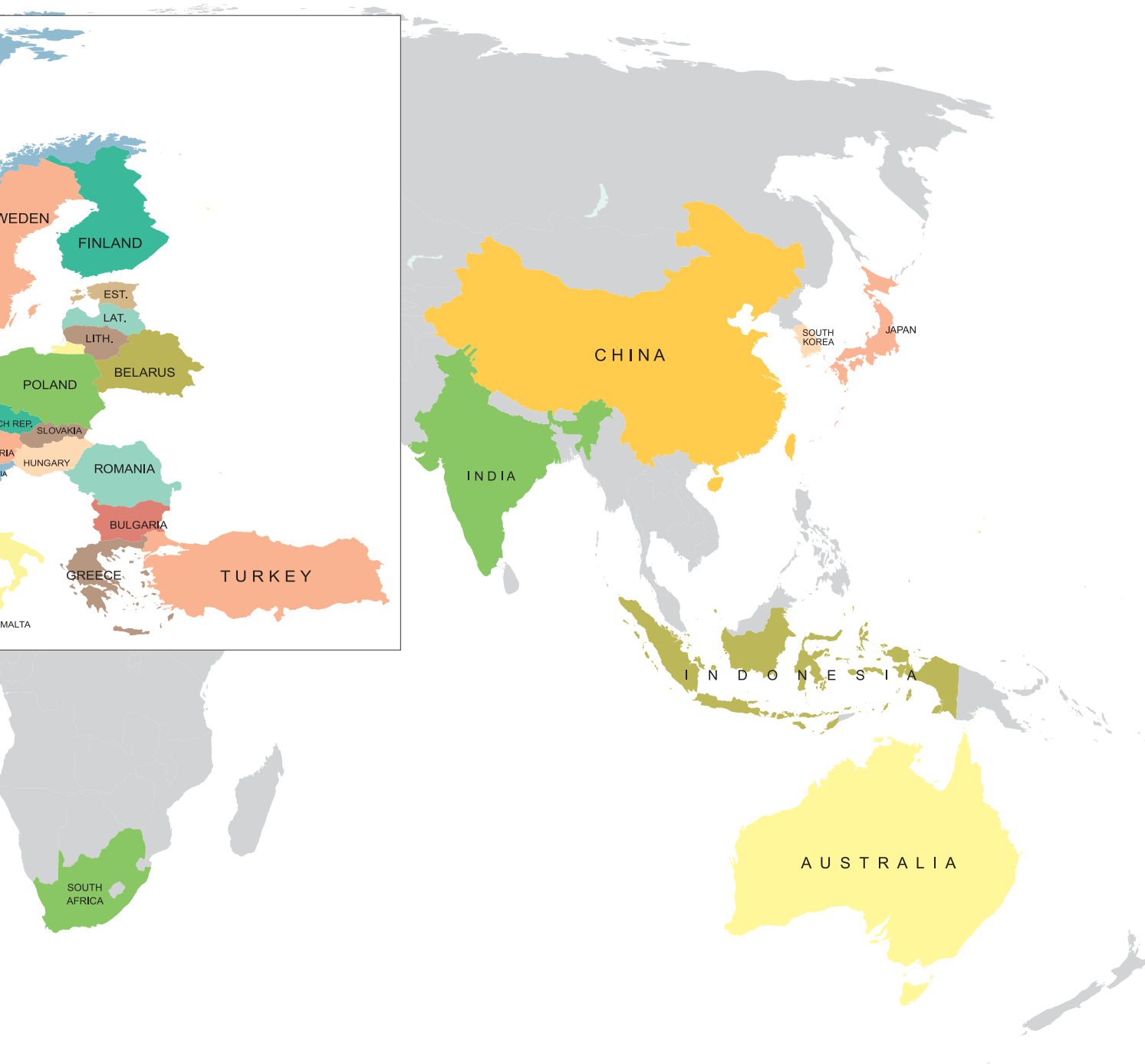
**RANK**

**INVESTMENT**

1. China \$34.6 billion
2. United States \$18.6 billion
3. United Kingdom \$11.2 billion
4. Rest of EU-27 \$10.8 billion  
(this category includes Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, Greece, Hungary, Ireland, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia and Sweden)

**RANK**

5. Spain
6. Brazil
7. Germany
8. Canada
9. Italy
10. India
11. Mexico
12. France



#### INVESTMENT

\$10.4 billion  
\$7.4 billion  
\$4.3 billion  
\$3.3 billion  
\$2.6 billion  
\$2.3 billion  
\$2.1 billion  
\$1.8 billion

#### RANK

13. Turkey
14. Australia
15. Japan
16. Indonesia
17. South Africa
18. Argentina
19. South Korea

#### INVESTMENT

\$1.6 billion  
\$1 billion  
\$800 million  
\$354 million  
\$125 million  
\$80 million  
\$20 million

Even though overall clean energy finance and investment in the United States more than doubled during the past five years, its growth rate lagged behind five other G-20 countries: Turkey (178 percent), Brazil and China (148 percent each), the United Kingdom (127 percent) and Italy (111 percent). In addition, the policy framework in the United States for reducing global warming pollution and increasing renewable energy remains uncertain, with comprehensive legislation stalled in Congress.

Other countries with strong clean energy policies—the United Kingdom, Germany, Spain and Brazil—remained leaders in 2009.

For additional detail on the performance of individual G-20 members, see Global Clean Energy Economy at a Glance on Page 14 and the country profiles beginning on Page 21.

## DOMESTIC POLICY CHOICES PLAY A CRITICAL ROLE

Domestic policy decisions appear to have shifted the competitive positions of G-20 member countries. Nations such as China, Brazil, Germany and Spain, which have adopted national renewable energy and energy efficiency standards, feed-in tariffs,<sup>3</sup> carbon reduction targets and/or financial incentives for investment and production, are assuming leadership positions in the clean energy sector. China, for example, has set ambitious targets for wind, biomass and solar energy. EU members have an economywide cap on carbon emissions and ambitious reduction goals. Brazil has set ambitious targets for ethanol fuel.

Other nations seeking to compete effectively for clean energy jobs and manufacturing could mimic the array of policy mechanisms that can be employed to stimulate clean energy investment. The United States is a case in point. With a mixed

FIGURE 7. TOP 10 IN INVESTMENT INTENSITY

Spain	0.74%
United Kingdom	0.51%
China	0.39%
Brazil	0.37%
Rest of EU-27	0.26%
Canada	0.25%
Turkey	0.19%
Germany	0.15%
Italy	0.14%
Mexico	0.14%

policy framework (for instance, no carbon policy and a patchwork of state renewable energy standards), the United States has a comparatively weak clean energy economy given the relative size of its overall economy. The United States, with 0.13 percent, ranked 11th among G-20 nations for 2009 in clean energy investment intensity—clean energy investment as a percentage of gross domestic product (Figure 7). However, with significant natural and intellectual resources and a strong culture of entrepreneurship, a strengthened policy framework could enable the United States to regain a leadership role in the coming years.

## WIND AND SOLAR LEAD INVESTMENTS

The wind energy sector was the primary recipient of clean energy investment in 2009, reflecting its mature status as a large-scale power generation source. Wind energy accounts for more than 50 percent of worldwide clean energy investment and almost half of installed clean energy capacity worldwide. Recognized as a clean, safe, price-competitive resource, wind energy is being deployed as an important new source of electricity generation in the leading clean energy economies.

The solar sector, on the strength of U.S., Spanish

<sup>3</sup> Feed-in tariffs are a policy mechanism to incentivize renewable energy production. They guarantee that electricity generated from renewable energy sources will be purchased by utilities at a set price over the life of a contract, usually long-term.

and EU investments, also figures prominently in G-20 investment portfolios. Although smaller in size than its wind energy counterpart, the solar sector is poised to expand. Solar energy prices have declined significantly in recent years, and the potential of new, thin-film technologies positions solar for significant growth.

By contrast, the sharp spikes in biofuel investment that occurred from 2006 to 2007 have plunged in the last two years.

### ASSET FINANCING DOMINATES

Pew identified trends in three types of investments and financing that are critical to technology R&D, manufacturing scale-up and project rollout in the clean energy sector:

- 1. Asset financing.** Typically associated with the installation of clean energy equipment and generating capacity, asset financing is the dominant class of clean energy finance. Because of the fiscal crisis, asset financing in 2009 fell 6 percent from the year before. Still, \$94.9 billion, more than 80 percent of all clean energy financing, was invested in physical assets that generate energy (power, heat, fuels), with onshore wind being the dominant sector because of its relative maturity and scalability. China was the leader in asset financing, followed by the United States.
- 2. Public market financing.** This class, which includes initial public offerings (IPOs), enables companies to raise capital for expansion and growth. In 2007, public funding peaked at \$23 billion. But G-20 public offerings declined by 45 percent over the last two years, with many companies canceling their IPOs because of poor market conditions. Total public fundraising of \$12.1 billion in 2009 constituted less than 11 percent of G-20 clean energy

investment. However, an extended IPO drought was broken late in 2009, particularly in China.

### 3. Venture capital/private equity financing.

This class is closely linked with technology innovation and development. Reflecting the overall market downturn, venture capital/private equity financing dropped 43 percent in 2009, to \$6.4 billion. The United States remained the overwhelming leader in venture capital investment, with priority given to next-generation biofuels, advanced solar, energy efficiency and smart grid technologies. Brazil came in a distant second.

### RENEWABLE CAPACITY GROWING WORLDWIDE

The United States led the world in installed wind, biomass and geothermal power capacity but was very close to losing its top position in overall installed capacity as China surged forward. Despite pioneering development of numerous key solar technologies, the United States lagged well behind G-20 leaders in installed solar capacity. Germany was the undisputed leader in the solar sector. The advent of regional and global carbon trading markets, along with strong policy frameworks in countries such as Spain, Brazil, India and China, accounts for the relative strength of these nations' clean energy sectors.

### GOVERNMENTS ALLOCATE STIMULUS FUNDS TO CLEAN ENERGY

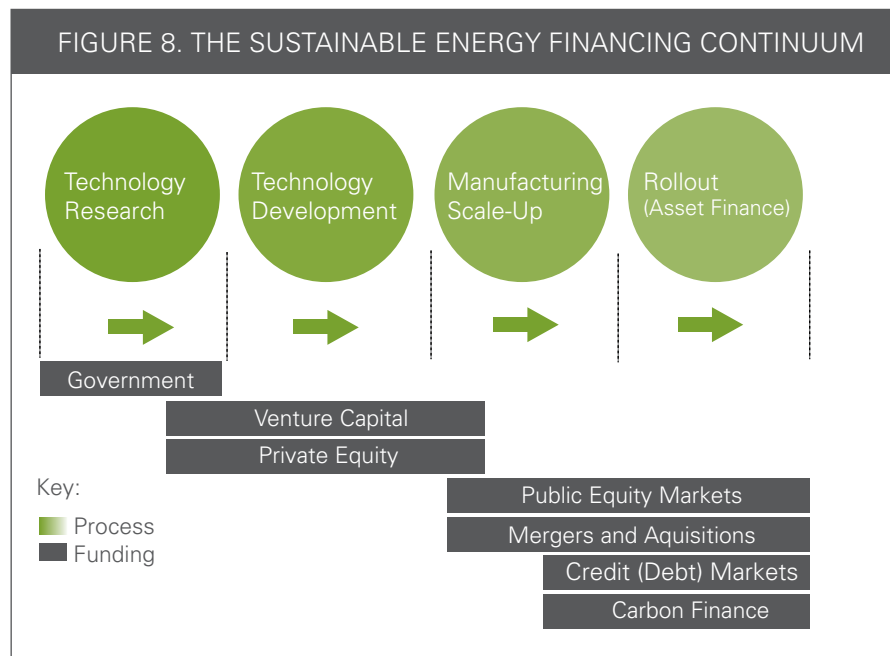
Global stimulus plans target \$184 billion for clean energy, led by the United States (\$67 billion) and China (\$47 billion). By the end of 2009, only 9 percent (\$16.6 billion) had reached the sector, with the United States and South Korea spending the most to date. Two-thirds of the stimulus funding is projected to be spent during 2010 and 2011.

### About the Investment Data

This report presents data on 2009 clean energy finance and investment in G-20 nations. The primary focus of this report is on investment because it propels the innovation, commercialization, manufacturing and installation of clean energy technologies. Public and private investments in R&D (totaling some \$25 billion in 2009) are not included in the G-20 investment presentations. No data are presented for G-20 members Russia and Saudi Arabia because clean energy investment there negligible. Spain, a member of the European Union but not an individual member of the G-20, is presented independently in this report in view of the size and relevance of its clean energy sector. For more details on the research methodology underlying this report, please see the appendix.

Bloomberg New Energy Finance tracks thousands of transactions across the spectrum of clean energy finance, from R&D funding and venture capital invested in technology and early-stage companies, to the public market and asset financing used to finance business growth and clean energy deployment. The key investment categories are:

- *Asset Financing:* This category includes all money invested in renewable energy generation projects, whether from internal company balance sheets, debt finance or equity finance. It excludes refinancing and short-term construction loans. Asset financing typically is associated with installation of clean energy equipment and generating capacity.
- *Public Markets:* This category includes all money invested in the equity of publicly traded companies developing renewable energy technology and clean power generation. Public market finance is typically associated with the scale-up phase, when companies are raising capital in public stock markets to finance product manufacturing and rollout. Investment in companies setting up generating capacity is included in the next category.
- *Venture Capital/Private Equity:* This category includes all money invested by venture capital funds in the equity of companies developing renewable energy technology. In general, venture capital is invested at the innovation stage, when companies are proving the market potential of goods and services.



### America's Clean Energy Economy

Pew first documented the clean energy economy in the United States in June 2009 in its report *The Clean Energy Economy: Repowering Jobs, Businesses and Investments Across America*.

According to Pew, "a clean energy economy generates jobs, businesses and investments while expanding clean energy production, increasing energy efficiency, reducing greenhouse gas emissions, waste and pollution, and conserving water and other natural resources." The definition provides a groundbreaking framework for tracking jobs, investments and economic growth and for allowing the public and private sectors to evaluate the effectiveness of policy choices and investments.

The study found that clean energy is emerging as a vital new sector in the U.S. economic landscape. It counted jobs, companies and investments in every state and found that from 1998 to 2007, jobs in the clean energy sector grew 2.5 times faster than jobs overall. By 2007, the last year for which data are available, more than 68,000 businesses across 50 states and the District of Columbia had created 770,000 jobs in the clean energy economy. Further, our research showed that these jobs are poised for even greater growth, driven by increasing consumer demand, venture capital infusions by investors eager to exploit new market opportunities, and state and federal policy initiatives. "Clean tech is where [information technology] was 30 years ago and biotech was 20 years ago; we're way early in the innovation cycle," said David Prend, managing partner of RockPort Capital and director of the National Venture Capital Association.



# The Global Clean Energy Economy at a Glance

## OVERALL

### **Five-Year Surge in Clean Energy Investment:**

Between 2005 and 2009, clean energy investments increased 230 percent globally. In the past two years, G-20 members invested an average of \$32 billion each quarter in the sector. Installed renewable energy capacity in 2009 increased to 250 GW, enough to power an estimated 75 million households and equivalent to 6 percent of the worldwide energy generation total.

### **Clean Energy Economy Weathers the Global**

**Financial Crisis:** In 2009, more than \$162 billion was invested globally. In the face of the global economic downturn, that figure declined only 6.6 percent compared with 2008. Moreover, the clean energy sector outperformed the oil and gas industry, which had investment declines of 19 percent in 2009, according to the International Energy Agency's *2009 World Energy Outlook*.

### **G-20 Countries Dominate the Clean Energy Economy, Compete for Leadership:**

G-20 countries account for more than 90 percent of all clean energy finance and investment. Countries with strong policy frameworks (China, Germany, Spain and Brazil, for example) have the strongest clean energy sectors relative to the size of their economies, while those with weaker policy frameworks (such as the United States, Japan, Australia and South Africa) lag behind their G-20 counterparts.

### **Countries Prioritize Clean Energy in Recovery**

**Strategies:** Global stimulus plans target \$184 billion for clean energy, led by the United States (\$67 billion) and China (\$47 billion). The full impact is still ahead: In 2009, less than 10 percent of these funds reached the clean energy sector; two-thirds of the stimulus funding is projected to be spent during 2010 and 2011.

**Asian Investment Soars in 2009:** Clean energy investment in Asia increased 37 percent in 2009 to \$39.02 billion. Strong demand for wind power in China and the availability of credit in Asian markets drove growth in the region. By contrast, investment declined 33 and 16 percent, respectively, in the Americas and Europe as the economy slowed, energy demand sagged and credit markets tightened.

**2009 Venture Capital Investments Drop More Than 40 Percent:** Venture capital investments fell more than 40 percent, to \$6.4 billion. The United States still dominates this asset class, accounting for 60 percent of all venture capital/private equity financing.

**Estimated \$200 Billion to Be Invested in 2010 in Energy, Climate and Jobs:** The ongoing priority for energy security, global warming pollution reduction and job creation will drive investment up 25 percent to a record \$200 billion in 2010, Bloomberg New Energy Finance forecasts.

## Looking Ahead

Pew is working on a second report that will investigate the direction of the clean energy economy in G-20 countries in the years to come. That report will harness Bloomberg New Energy Finance's advanced modelling capabilities to explore the contribution clean energy can make to the world's economic and environmental future if certain policies and measures are adopted nationally by governments to accelerate private finance and investment.



## COMPETITIVENESS SNAPSHOTS OF G-20 MEMBERS

**China:** With clean energy investments up more than 50 percent in 2009, China took the lead among G-20 nations for the first time. China's 2009 financing totaled \$34.6 billion (Figure 4). Ambitious, mandatory targets for wind and solar power and the ample availability of credit in China have been the primary engines of that nation's clean energy growth. Having built a strong manufacturing base and export markets, China is working now to meet domestic demand by installing substantial new clean energy generating capacity to achieve its renewable energy targets.

**United States:** The United States closed 2009 with total investments of \$18.6 billion. The United States lost the top spot in the G-20 for the first time in five years. The economic recession and investor uncertainty about tax incentives early in the year slowed investments, which were down 40 percent from 2008 levels. State renewable energy standards and enactment of longer-term production and investment tax credits in February spurred substantial investments later in 2009. The United States continued to dominate the venture capital/private equity investments associated with technology innovation. Investors continued to look to Congress to pass comprehensive climate and energy legislation that will provide long-term certainty for investment.

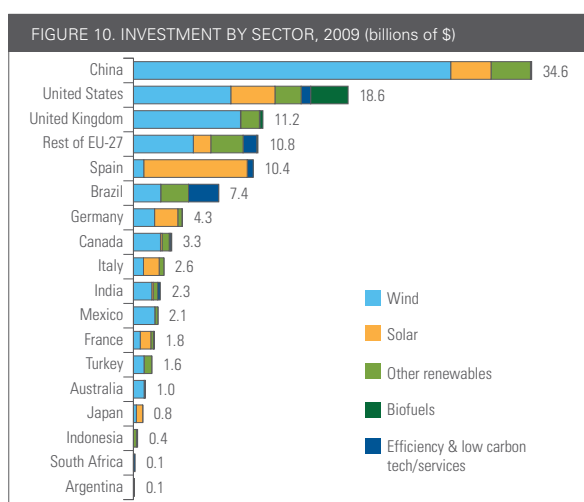
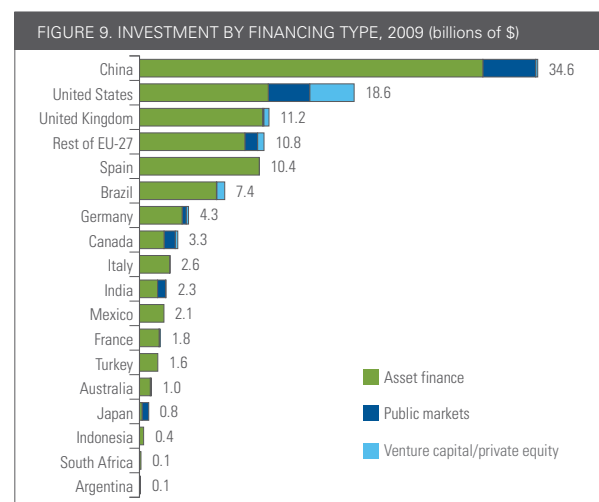
**United Kingdom:** Large offshore wind deals backed by the government put the United Kingdom in third place in the G-20, with 2009 investments of \$11.2 billion. The United Kingdom also was at the forefront of marine energy investments.

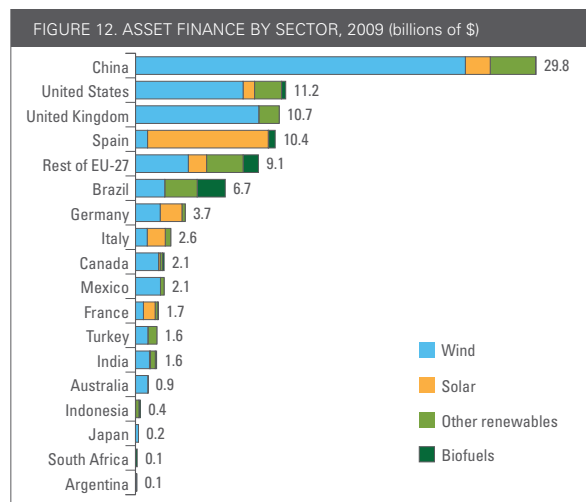
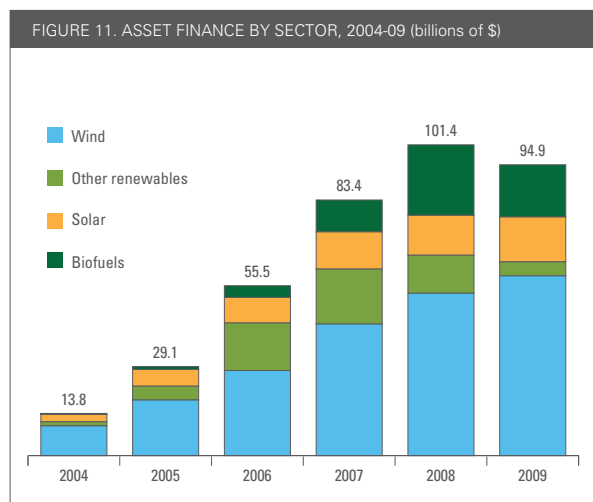
**Spain:** Within the European Union, Spain remained a clean energy leader with 2009 investments of more than \$10 billion, much of it in solar energy. Spanish budget constraints forced cutbacks in incentive programs, which significantly curtailed 2009 investments and will likely continue to do so in the future.

**Brazil:** Brazil, which is poised for significant growth in wind energy investments, stood out as a G-20 leader. Brazil invested \$7.4 billion in clean energy in 2009.

**Germany:** Germany remained a clean energy stalwart in terms of manufacturing and installed capacity, especially in the solar sector. Overall, Germany invested \$4.3 billion in clean energy in 2009.

**European Union:** EU carbon policies established European renewable energy markets early, and investment and installed capacity continue at a steady pace across Europe.





## ASSET FINANCING

Asset financing, typically associated with the installation of clean energy equipment and generating capacity, is a barometer of clean energy deployment and the creation of new jobs. It is the dominant class of clean energy finance.

Because of the financial crisis, asset financing in 2009 was down 6 percent from 2008. Still, more than 80 percent of all clean energy financing (\$95 billion) was invested in physical assets that generate energy (power, heat, fuels), with onshore wind being the dominant sector because of its relative maturity and scalability (Figure 11).

Key observations include:

- Asset financing in clean energy increased threefold from 2005 levels. These investments helped increase total installed renewable energy capacity to 250 GW

worldwide.

- China led the way in asset financing with investments of \$29.8 billion, 86 percent of its total clean energy financing (Figure 12). The United States was next with \$11.2 billion, followed by the United Kingdom at \$10.7 billion, much of it focused on offshore wind assets. Spain was the other top asset financing destination with \$10.4 billion.
- U.S. asset financing was down in response to the financial crisis, uncertainty about the Production Tax Credit and a lack of credit liquidity. Asset financing for biofuels production in the United States also contracted significantly from 2006-07 highs.

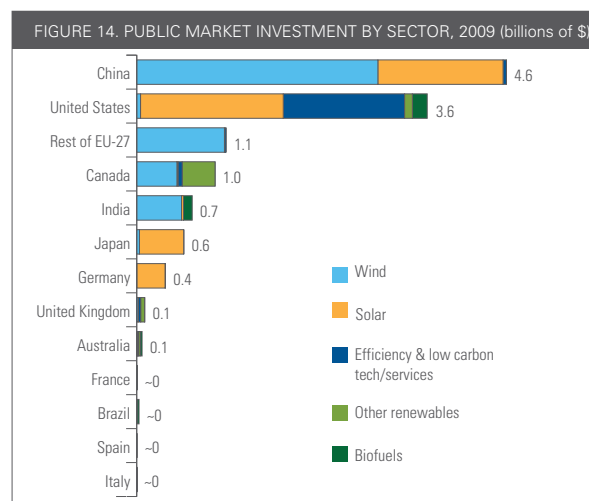
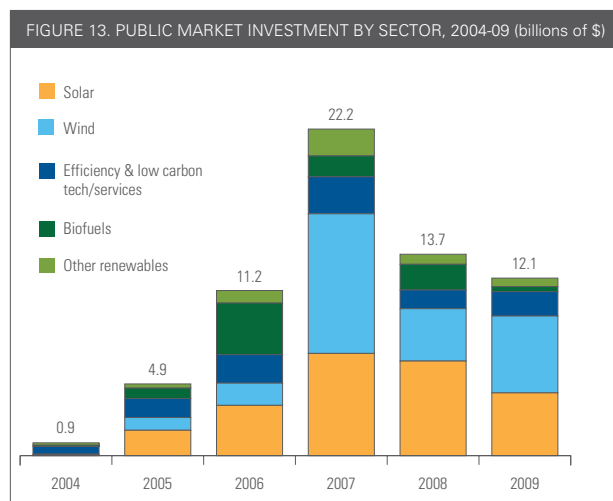
## PUBLIC MARKET FINANCING

Public market financing enables companies to raise capital for expansion and growth.

As the clean energy economy emerged in the middle of the past decade, many clean energy companies used stock markets to fund their growth plans. At its peak in 2007, public market funding reached \$22 billion (Figure 13). But G-20 public offerings declined by 45 percent in the past two years, with many companies canceling their IPOs because of poor market conditions. Total public fundraising of \$12.1 billion in 2009 constituted less than 11 percent of G-20 clean energy investment (Figure 14). However, an extended IPO drought was broken late in 2009.

Key observations include:

- Investor demand, which had inflated clean energy company valuations significantly, collapsed during the financial crisis, lowering stock prices and dramatically slowing market investment in the sector.
- Established companies are now raising capital to strengthen their balance sheets rather than to fund growth plans.
- Nonetheless, European wind and solar companies are financing expansion of their manufacturing capacity and project portfolios.
- Strong IPO activity occurred in China in late 2009 to finance growth in manufacturing capacity.



## VENTURE CAPITAL/PRIVATE EQUITY FINANCING

Venture capital and private equity financing are closely linked with technology innovation and development (Figure 15).

Reflecting the overall market downturn, this class of clean energy finance was down 44 percent in 2009. The United States remained the enduring leader in venture capital investment, reflecting its strong foundation of technology innovation (Figure 16). Brazil came in a distant second, while venture capital investments in other developing countries such as China and India were negligible.

Key observations include:

- There was a significant influx of venture capital into next-generation biofuels such as cellulosic and algae fuels.
- New solar and energy efficiency/smart grid technologies also saw substantial venture capital investment.
- In response to the financial crisis, venture capitalists retreated from new companies and concentrated instead on well-established entities. For example, in 2009 there were only 70 investments in Series A shares (first stock offerings by a company) compared with 150 in 2007.
- This situation could persist until venture capitalists shift investments as companies scale up with public market financing.

FIGURE 15. VENTURE CAPITAL/PRIVATE EQUITY FINANCING BY SECTOR, 2004-09 (billions of \$)

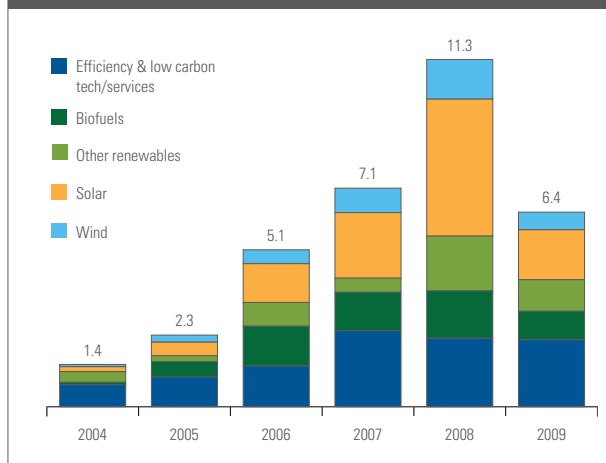
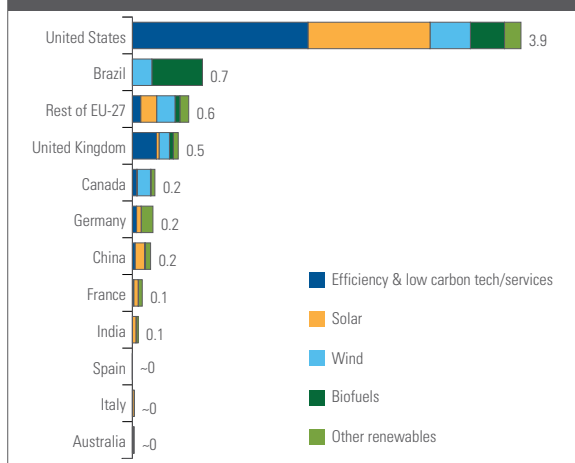


FIGURE 16. VENTURE CAPITAL/PRIVATE EQUITY FINANCING BY SECTOR, 2009 (billions of \$)



## INSTALLED RENEWABLE ENERGY CAPACITY

The total global renewable energy capacity is 250 GW. Key observations include:

- At the end of 2009, the United States led the world in installed wind, biomass (Figure 17) and geothermal power capacity (Figure 18) but was very close to losing its lead in overall installed capacity to China. Despite pioneering development of numerous key solar technologies, the United States lags well behind G-20 leaders in installed solar capacity.
- Germany is the undisputed leader in the solar sector with a total installed capacity of 5.3 GW. Japan and Spain, both with about 2.1 GW, were the next-leading countries for installed solar power capacity.
- China doubled its wind capacity in 2009 in pursuit of an ambitious target of installing 30 GW of wind by 2020. China also led the G-20 in small hydro capacity and moved aggressively in the solar sector.
- The advent of regional and global carbon trading markets, along with strong policy frameworks in countries such as Spain, Brazil, India and China, accounts for the relative strength of these nations' clean energy sectors.

FIGURE 17. INSTALLED RENEWABLE ENERGY CAPACITY, 2009 (in GW)  
(wind, small hydro, biomass and waste)

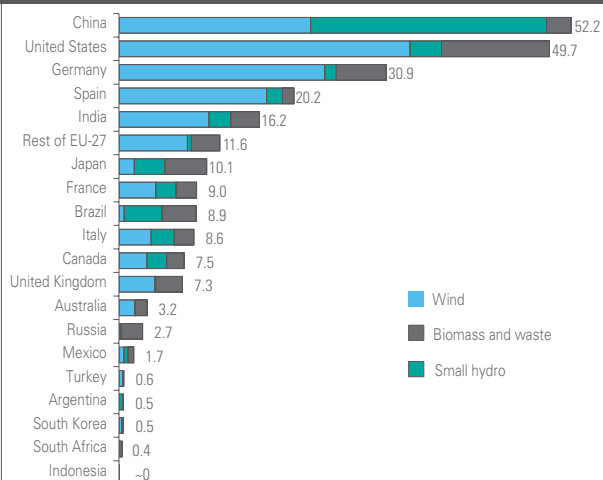
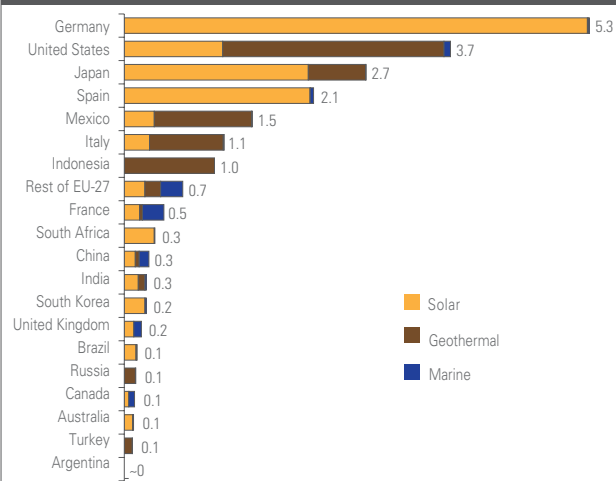


FIGURE 18. INSTALLED RENEWABLE ENERGY CAPACITY, 2009 (in GW)  
(solar, geothermal, marine)

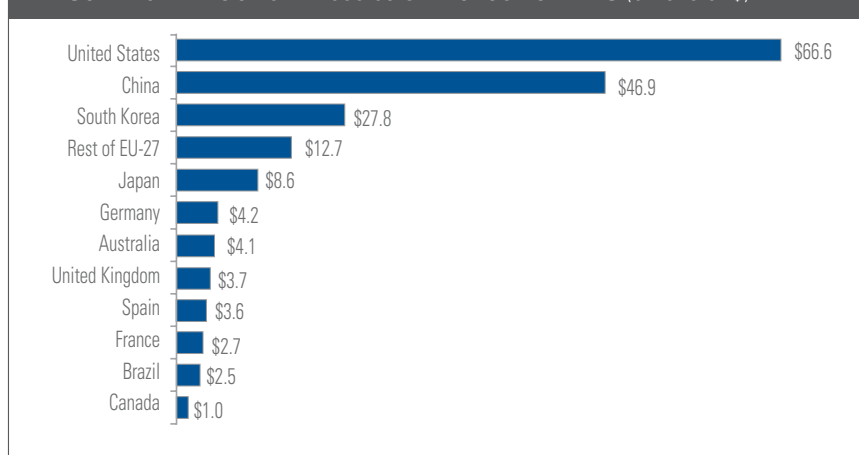


## G-20 STIMULUS FUNDING FOR CLEAN ENERGY

An estimated \$184 billion was earmarked for clean energy by the various government stimulus packages announced in late 2008 and early 2009. Key observations include:

- The greatest amount of stimulus money was allocated for clean energy by the United States and China.
- By the end of 2009, only 9 percent (\$16.6 billion) had reached the sector. The most money had been spent by the United States (about \$8 billion) and South Korea (nearly \$3.3 billion).
- According to industry estimates, two-thirds of financial recovery funding is projected to be spent during 2010 and 2011.
- The United States allocated stimulus funding for energy efficiency, renewable energy deployment, transportation and smart grid technology.
- China intends to spend \$46.9 billion in stimulus funding on energy efficiency, clean vehicles, grid infrastructure and other clean energy technology. Its "Golden Sun" initiative will grant up to 50 percent of the installation cost of photovoltaic power plants in China.
- The South Korean government intends to increase its share of the overseas green market by allocating stimulus funding to boost exports of LED lighting products, solar cells, hybrid cars and other low-carbon technology products.

FIGURE 19. ANNOUNCED 2008-09 STIMULUS FUNDING (billions of \$)

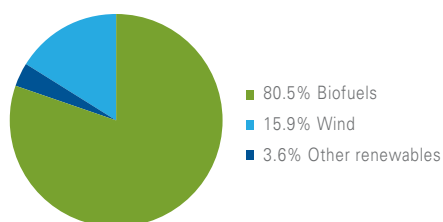


## G-20 Country Profiles

The following pages profile the clean energy sector in each of the G-20 member countries. These profiles highlight each country's priorities and progress, along with key renewable energy targets and incentives developed to encourage growth in the clean energy sector.

Argentina's 2009 investment totaled only \$80 million, ranking 18th among the G-20 members. Renewable energy accounts for less than 2 percent of Argentina's power capacity. The country's policy framework is aimed primarily at displacing oil through development of biofuels, which attracted 75 percent of 2009 clean energy investment. Argentina's 2016 renewable energy target (8 percent of power generation) will require a fourfold increase in installed clean power capacity.

DISTRIBUTION OF INVESTMENT, BY SECTOR (2005-09)



NATIONAL CLEAN ENERGY POLICIES

Carbon Cap	✓
Carbon Market	
Renewable Energy Standard	✓
Clean Energy Tax Incentives	✓
Auto Efficiency Standards	✓
Feed-in Tariffs	✓
Government Procurement	
Green Bonds	✓

FINANCE AND INVESTMENT (2009)

Total Investment	\$80 million
G-20 Investment Rank	18
Percentage of G-20 Total	0.1%
5-Year Growth Rate	N/A

INSTALLED CLEAN ENERGY (2009)

Total Installed Renewable Energy	0.5 GW
Total Power Capacity	1.9%
Percentage of G-20 Total	0.2%
5-Year Growth Rate	0.1%
Key Renewable Energy Sectors	
Wind	500 MW
Small-Hydro	436 MW

KEY CLEAN ENERGY TARGETS (2012)

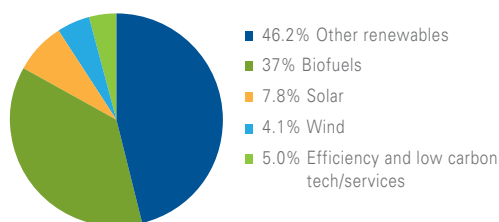
Renewable Energy	8% of total power generation (by 2016)
Ethanol	5% of total gasoline consumption
Biodiesel	5% of total diesel consumption

KEY INVESTMENT INCENTIVES

Wind, Solar, Biomass, Small-Hydro	Production Tax Credits (PTC)
Biofuel	Tax exemption for producers and guaranteed fixed prices set by government



Australia's clean energy sector recovered from a 50 percent drop in 2008 with clean energy investment of \$1 billion in 2009, putting it 14th among the G-20 members. Australia has significant installed wind capacity and intends for wind to play a key role in achievement of the nation's 20 percent renewable energy target for 2020. To achieve this goal, substantially increased finance and investment will be needed in the next decade.

**DISTRIBUTION OF INVESTMENT, BY SECTOR (2005-09)**

**NATIONAL CLEAN ENERGY POLICIES**

Carbon Cap	
Carbon Market	
Renewable Energy Standard	✓
Clean Energy Tax Incentives	✓
Auto Efficiency Standards	✓
Feed-in Tariffs	✓
Government Procurement	
Green Bonds	

**FINANCE AND INVESTMENT (2009)**

Total Investment	\$1 billion
G-20 Investment Rank	14
Percentage of G-20 Total	0.9%
5-Year Growth Rate	62.5%

**INSTALLED CLEAN ENERGY (2009)**

Total Installed Renewable Energy	3.3 GW
Total Power Capacity	3.1%
Percentage of G-20 Total	1.2%
5-Year Growth Rate	40.0%
<b>Key Renewable Energy Sectors</b>	
Wind	1,900 MW
Biomass	280 MW

**KEY CLEAN ENERGY TARGETS (2020)**

Renewable Energy	20% of total consumption
Solar	1,000 MW

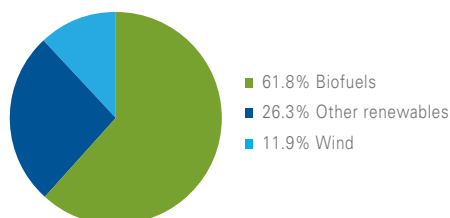
**KEY INVESTMENT INCENTIVES**

Solar	Generation-based subsidies
Renewable Energy	Equity Fund—venture capital for small renewable energy companies



Brazil is sixth among G-20 members for investments in clean energy and second to China among emerging economies. While investments declined in 2009 due to the financial downturn, Brazil experienced the second-highest investment growth rate over the past five years. With 9 GW of renewable energy capacity and the world's leading ethanol infrastructure, relative to the size of its economy, Brazil stands out as a clear clean energy leader. Brazil has among the world's highest biomass and small-hydro power capacities. The country offers priority loans for renewable power projects and ambitious targets for ethanol.

DISTRIBUTION OF INVESTMENT, BY SECTOR (2005-09)



NATIONAL CLEAN ENERGY POLICIES

Carbon Cap	
Carbon Market	
Renewable Energy Standard	✓
Clean Energy Tax Incentives	✓
Auto Efficiency Standards	✓
Feed-in Tariffs	✓
Government Procurement	
Green Bonds	✓

FINANCE AND INVESTMENT (2009)

Total Investment	\$7.4 billion
G-20 Investment Rank	6
Percentage of G-20 Total	6.5%
5-Year Growth Rate	147.8%

INSTALLED CLEAN ENERGY (2009)

Total Renewable Energy Capacity	9.1 GW
Total Power Capacity	9.8%
Percentage of G-20 Total	3.2%
5-Year Growth Rate	13.9%
Key Renewable Energy Sectors	
Ethanol (liters)	30 billion
Biomass	5,100 MW
Small-Hydro	4,100 MW

KEY CLEAN ENERGY TARGETS (2012)

Wind	1422 MW
Ethanol	25% of total gasoline consumption
Biodiesel	5% of total diesel consumption

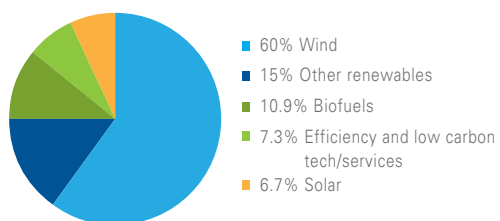
KEY INVESTMENT INCENTIVES

Wind	Generation-based subsidies/Preferential BNDES loans
Small-Hydro	Generation-based subsidies/Preferential BNDES loans
Biomass	Generation-based subsidies/Preferential BNDES loans



Canada saw \$3.3 billion invested in its clean energy sector in 2009, an 80 percent annual increase and 3 percent of the G-20 total, ranking it eighth overall. Canada has 7.6 GW of renewable energy. Canada provides policy incentives primarily at the provincial level. Wind and mini-hydro are the leading sectors and benefit from strong support from provincial governments.

DISTRIBUTION OF INVESTMENT, BY SECTOR (2005-09)



NATIONAL CLEAN ENERGY POLICIES

Carbon Cap	
Carbon Market	
Renewable Energy Standard	
Clean Energy Tax Incentives	✓
Auto Efficiency Standards	✓
Feed-in Tariffs	
Government Procurement	
Green Bonds	

FINANCE AND INVESTMENT (2009)

Total Investment	\$3.3 billion
G-20 Investment Rank	8
Percentage of G-20 Total	2.9%
5-Year Growth Rate	70.2%

INSTALLED CLEAN ENERGY (2009)

Total Renewable Energy Capacity	7.6 GW
Total Power Capacity	4.3%
Percentage of G-20 Total	2.7%
5-Year Growth Rate	18.1%
Key Renewable Energy Sectors	
Wind	3,056 MW
Small-Hydro	2,000 MW

KEY CLEAN ENERGY TARGETS (2020)

Wind (Quebec only)	4,700 MW
Solar	500 MW

KEY INVESTMENT INCENTIVES\*

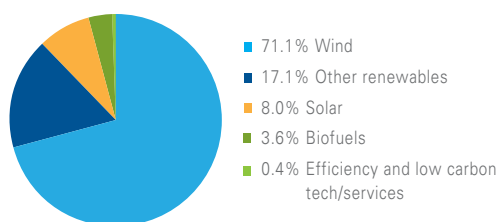
Wind, Solar, Biomass	Generation-based subsidies /Preferential loans
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\*Incentives primarily through provincial governments



For the first time, China led the world in clean energy investments in 2009. With 52.5 GW of renewable energy, China is second in the world for installed capacity, just behind the United States. China has 12.2 GW of wind, supported by a fixed-rate feed-in tariff. It also has some of the world's most ambitious renewable targets, calling for 30 GW each from wind and biomass energy by 2020. China has built a strong manufacturing base, particularly in solar, and is moving to meet growing domestic energy consumption through rapid installation of clean energy power generation capacity.

#### DISTRIBUTION OF INVESTMENT, BY SECTOR (2005-09)



#### NATIONAL CLEAN ENERGY POLICIES

Carbon Cap	
Carbon Market	
Renewable Energy Standard	✓
Clean Energy Tax Incentives	✓
Auto Efficiency Standards	✓
Feed-in Tariffs	✓
Government Procurement	
Green Bonds	✓

#### FINANCE AND INVESTMENT (2009)

Total Investment	\$34.6 billion
G-20 Investment Rank	1
Percentage of G-20 Total	30.5%
5-Year Growth Rate	147.5%

#### INSTALLED CLEAN ENERGY (2009)

Total Renewable Energy Capacity	52.5 GW
Total Power Capacity	4%
Percentage of G-20 Total	16.5%
5-Year Growth Rate	78.9%
Key Renewable Energy Sectors	
Wind	12,200 MW
Biomass	2,880 MW
Solar PV	140 MW

#### KEY CLEAN ENERGY TARGETS (2020)

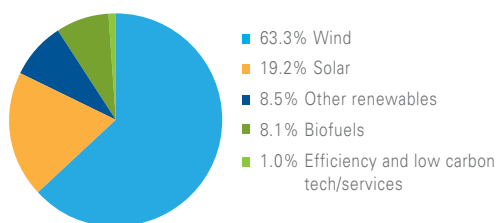
Wind	30,000 MW
Biomass	30,000 MW
Solar	1,800 MW

#### KEY INVESTMENT INCENTIVES

Wind	Fixed feed-in tariff
Renewable Energy	Renewable energy surcharge and subsidy scheme
Solar	Rooftop and building integrated photovoltaic tax subsidies

France's 2009 clean energy investments of \$1.8 billion place it 12th among the G-20 members. France has a strong utility policy framework, providing feed-in tariffs for most forms of renewable power. France's goal is to secure 10 percent of overall energy from renewable sources by year's end, up from 8 percent at the end of 2008. Low electricity prices due to nuclear power also provide potential for funding renewable power subsidy programs through consumers in the long run.

#### DISTRIBUTION OF INVESTMENT, BY SECTOR (2005-09)



#### NATIONAL CLEAN ENERGY POLICIES

Carbon Cap	
Carbon Market	✓
Renewable Energy Standard	✓
Clean Energy Tax Incentives	✓
Auto Efficiency Standards	
Feed-in Tariffs	✓
Government Procurement	
Green Bonds	

#### FINANCE AND INVESTMENT (2009)

Total Investment	\$1.8 billion
G-20 Investment Rank	12
Percentage of G-20 Total	1.6%
5-Year Growth Rate	97.9%

#### INSTALLED CLEAN ENERGY (2009)

Total Renewable Energy Capacity	9.4 GW
Total Power Capacity	8.1%
Percentage of G-20 Total	3.5%
5-Year Growth Rate	31.3%
Key Renewable Energy Sectors	
Wind	3,400 MW
Biomass	467 MW
Solar PV	346 MW

#### KEY CLEAN ENERGY TARGETS

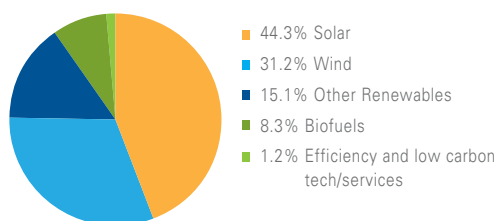
Renewable Energy	10% of total energy consumption by 2010
Biofuels	10% of total fuel consumption by 2015
Efficiency	38% decrease in energy consumption by 2020

#### KEY INVESTMENT INCENTIVES

Wind, Solar, Biogas	Feed-in tariffs
RE Equipment	Tax credit for RE equipment used for residential power

Germany's 2009 clean energy investments of \$4.3 billion rank it seventh in the G-20. Germany is a long-standing global leader in the clean energy economy, with installed renewable energy at 29 percent of total power capacity, including 7.8 GW of solar and 23.9 GW of wind. Germany's investment rose more than 18 percent in 2009, and the country saw a 75 percent growth rate during the past five years. Excellent government support and generous have been key factors in the sector's development.

#### DISTRIBUTION OF INVESTMENT, BY SECTOR (2005-09)



#### NATIONAL CLEAN ENERGY POLICIES

Carbon Cap	
Carbon Market	✓
Renewable Energy Standard	✓
Clean Energy Tax Incentives	✓
Auto Efficiency Standards	✓
Feed-in Tariffs	✓
Government Procurement	✓
Green Bonds	

#### FINANCE AND INVESTMENT (2009)

Total Investment	\$4.3 billion
G-20 Investment Rank	7
Percentage of G-20 Total	3.7%
5-Year Growth Rate	75.3%

#### INSTALLED CLEAN ENERGY (2009)

Total Renewable Energy Capacity	36.2 GW
Total Power Capacity	29.0%
Percentage of G-20 Total	14.6%
5-Year Growth Rate	14.4%
Key Renewable Energy Sectors	
Wind	23,900 MW
Solar	7,757 MW
Biomass	3,631 MW

#### KEY CLEAN ENERGY TARGETS (2030)

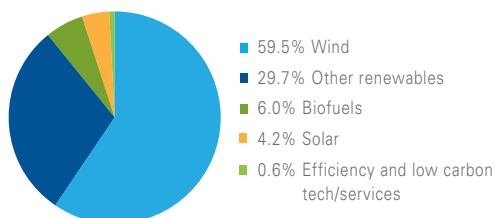
RE Heat	Procure 14% of heating resource from renewable energy
RE Electricity	Procure 25% to 30% of electricity resource from renewable energy

#### KEY INVESTMENT INCENTIVES

Wind, Solar, Biomass	Feed-in tariffs
Renewable Energy	Favorable credit terms with interest rates fixed in the 4% to 7% range
Solar PV	Commercial installations exempt from VAT

India is ranked 10th among G-20 members and constitutes 2.0 percent of total G-20 investment. With 11 GW, it is one of the leading nations for wind power backed by strong provincial feed-in tariff policies. India also has close to 5 GW of biomass and mini-hydro power backed by accelerated depreciation mechanisms. Renewable energy projects are provided a preferential tax rate of 15 percent compared with the standard rate of 30 percent. India recently announced its intention to acquire a massive 20 GW of solar by 2020.

#### DISTRIBUTION OF INVESTMENT, BY SECTOR (2005-09)



#### NATIONAL CLEAN ENERGY POLICIES

Carbon Cap	
Carbon Market	
Renewable Energy Standard	
Clean Energy Tax Incentives	✓
Auto Efficiency Standards	✓
Feed-in Tariffs	
Government Procurement	✓
Green Bonds	✓

#### FINANCE AND INVESTMENT (2009)

Total Investment	\$2.3 billion
G-20 Investment Rank	10
Percentage of G-20 Total	2%
5-Year Growth Rate	72.0%

#### INSTALLED CLEAN ENERGY (2009)

Total Renewable Energy Capacity	16.5 GW
Total Power Capacity	9.0%
Percentage of G-20 Total	6.6%
5-Year Growth Rate	31.0%

#### Key Renewable Energy Sectors

Wind	10,891 MW
Small-Hydro	2,520 MW
Biomass	2,057 MW

#### KEY CLEAN ENERGY TARGETS (2012)

Wind	17,582 MW
Small-Hydro	3,358 MW
Biomass	2,840 MW

#### KEY INVESTMENT INCENTIVES\*

Wind, Solar	Feed-in tariffs
Small-Hydro, Biomass	Accelerated depreciation of 80% in year one
Renewable Energy Projects	Preferential tax rate of 15% instead of the standard 30%

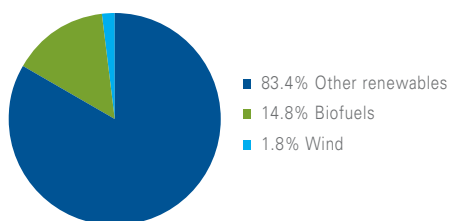
\*Incentives primarily through provincial investments





Investing \$354 million in 2009 in clean energy, Indonesia is ranked 16th among G-20 members. It is a popular destination for geothermal power investments, with an existing capacity of 880 megawatts and targets of acquiring 5 GW by 2025. Indonesia intends to secure 15 percent of all its electricity from renewable sources by 2025. However, questions about the stability of the political and regulatory environment in Indonesia may affect the flow of investments into clean energy assets.

DISTRIBUTION OF INVESTMENT, BY SECTOR (2005-09)



NATIONAL CLEAN ENERGY POLICIES

Carbon Cap	
Carbon Market	
Renewable Energy Standard	✓
Clean Energy Tax Incentives	✓
Auto Efficiency Standards	
Feed-in Tariffs	✓
Government Procurement	✓
Green Bonds	

FINANCE AND INVESTMENT (2009)

Total Investment	\$354 million
G-20 Investment Rank	16
Percentage of G-20 Total	0.3%
5-Year Growth Rate	94.5%

INSTALLED CLEAN ENERGY (2009)

Total Renewable Energy Capacity	1.1 GW
Total Power Capacity	4.2%
Percentage of G-20 Total	0.4%
5-Year Growth Rate	7.9%
Key Renewable Energy Sectors	
Geothermal	880 MW
Biomass	400 MW

KEY CLEAN ENERGY TARGETS (2025)

Geothermal	5,000 MW
Solar	500 MW
Renewable Energy Power	15% of all electricity to be sourced from clean energy

KEY CLEAN ENERGY INCENTIVES

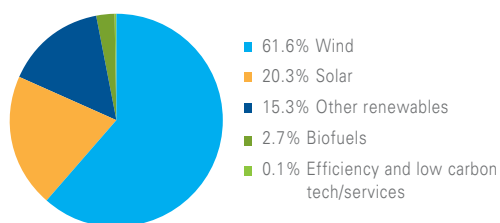
Geothermal	Preferential tariffs, no import duties
Renewable Energy Power	Guaranteed purchase of renewable power by state utilities





Clean energy investment in Italy constitutes 2.3 percent of the G-20 total, ranking it ninth. Italy has high electricity prices and it is the first country in which solar power has achieved parity with other electric sources. Italy's clean energy investment grew 110 percent during the past five years. Under EU policy, Italy has a target to generate at least 25 percent of its electricity from renewables. It offers feed-in tariffs for solar and wind while it subsidizes 30 percent of the capital expenditure cost of biomass power.

#### DISTRIBUTION OF INVESTMENT, BY SECTOR (2005-09)



#### NATIONAL CLEAN ENERGY POLICIES

Carbon Cap	
Carbon Market	✓
Renewable Energy Standard	✓
Clean Energy Tax Incentives	✓
Auto Efficiency Standards	✓
Feed-in Tariffs	✓
Government Procurement	✓
Green Bonds	

#### FINANCE AND INVESTMENT (2009)

Total Investment	\$2.6 billion
G-20 Investment Rank	9
Percentage of G-20 Total	2.3%
5-Year Growth Rate	110.6%

#### INSTALLED CLEAN ENERGY (2009)

Total Renewable Energy Capacity	9.8 GW
Total Power Capacity	4.9%
Percentage of G-20 Total	4.0%
5-Year Growth Rate	12.4%

#### Key Renewable Energy Sectors

Wind	3,700 MW
Solar	1,042 MW
Biomass	1,152 MW

#### KEY CLEAN ENERGY TARGETS (2010)

Renewable Energy Electricity	Procure 25% of electricity from renewable energy
Biofuels	5.75% of total fuel consumption

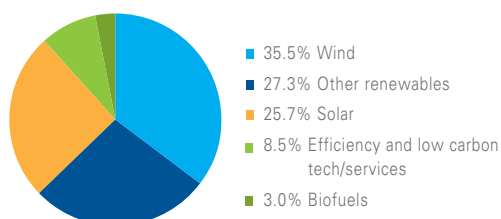
#### KEY INVESTMENT INCENTIVES

Wind, Solar, Biomass	Feed-in tariffs
Biomass	30% of capital expenditure for biomass and hybrid units
Residential Renewable Energy Projects	30-60% refund on capital costs of projects



Clean energy investment in Japan totaled less than \$1 billion in 2009, placing it in 15th position. Although its investments seem small in comparison to its G-20 counterparts, Japan is a leader in solar capacity, with 1.7 GW backed by feed-in tariffs. Japan has ambitious targets to source 28 GW from solar and 5 GW from wind by 2020, active pursuit of which would make it one of the G-20's most promising growth markets.

DISTRIBUTION OF INVESTMENT, BY SECTOR (2005-09)



NATIONAL CLEAN ENERGY POLICIES

Carbon Cap	
Carbon Market	
Renewable Energy Standard	✓
Clean Energy Tax Incentives	✓
Auto Efficiency Standards	✓
Feed-in Tariffs	✓
Government Procurement	
Green Bonds	✓

FINANCE AND INVESTMENT (2009)

Total Investment	\$800 million
G-20 Investment Rank	15
Percentage of G-20 Total	0.7%
5-Year Growth Rate	51.1%

INSTALLED CLEAN ENERGY (2009)

Total Renewable Energy Capacity	12.9 GW
Total Power Capacity	1.3%
Percentage of G-20 Total	5.2%
5-Year Growth Rate	4.2%
Key Renewable Energy Sectors	
Biomass	3,100 MW
Solar	1,700 MW

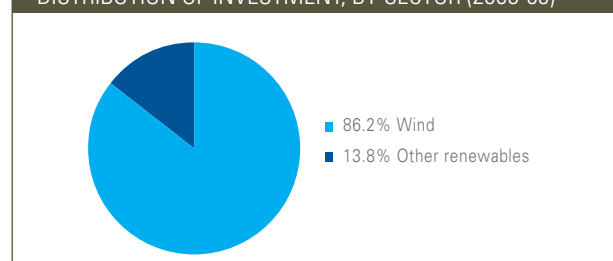
KEY CLEAN ENERGY TARGETS (2020)

Wind	5,000 MW
Solar	28,000 MW

KEY INVESTMENT INCENTIVES

Solar	Residential feed-in tariff
Energy Efficiency	Energy bank: Fund for energy efficiency and CO <sub>2</sub>

Mexico experienced a healthy \$2.1 billion in clean energy investments in 2009, placing it 11th among the G-20 countries. Existing renewable power capacity is primarily for supply to remote areas with an unstable grid. Mexico's current policy framework is insufficient to encourage substantial investments. Wind accounts for 86.2 percent of Mexico's 2009 clean energy investments.

**DISTRIBUTION OF INVESTMENT, BY SECTOR (2005-09)**

**NATIONAL CLEAN ENERGY POLICIES**

Carbon Cap	
Carbon Market	
Renewable Energy Standard	
Clean Energy Tax Incentives	✓
Auto Efficiency Standards	✓
Feed-in Tariffs	✓
Government Procurement	
Green Bonds	

**FINANCE AND INVESTMENT (2009)**

Total Investment	\$2.1 billion
G-20 Investment Rank	11
Percentage of G-20 Total	1.9%
5-Year Growth Rate	91.9%

**INSTALLED CLEAN ENERGY (2009)**

Total Renewable Energy Capacity	3.2 GW
Total Power Capacity	3.3%
Percentage of G-20 Total	1.0%
5-Year Growth Rate	10.1%
<b>Key Renewable Energy Sectors</b>	
Geothermal	965 MW
Biomass / Biogas	498 MW
Small Hydro	377 MW

**KEY CLEAN ENERGY TARGETS (2012)**

Wind	2,726 MW
Geothermal	1,036 MW
Ethanol	25% of total gasoline consumption
Biodiesel	5% of total diesel consumption

**KEY INVESTMENT INCENTIVES**

Wind	Generation-based subsidies
Geothermal	Generation-based subsidies
Biomass	Generation-based subsidies
Renewable Energy	50-70% discount on power transmission through renewable energy plants with capacity of 500 KW.



South Africa's 2009 investments of \$125 million in clean energy garner it 17th place in the G-20. South Africa has introduced feed-in tariffs for wind, solar and mini-hydro sectors, and it targets an installed capacity of 1,667 megawatts from renewables by 2013. The clean energy sector may benefit from South Africa's commitment to cut global warming pollution 34 percent from its current 2020 trajectory. Still, clean energy investments in South Africa remain insignificant. There is insufficient reliable data on installed capacity within the country, and it has thus been excluded from this profile.

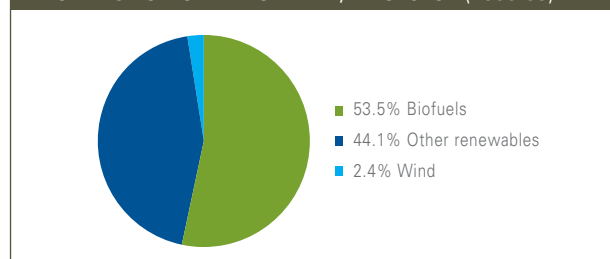
#### FINANCE AND INVESTMENT (2009)

Total Investment	\$125 million
G-20 Investment Rank	17
Percentage of G-20 Total	0.1%
5-Year Growth Rate	N/A

#### KEY CLEAN ENERGY TARGETS (2012)

Renewable Energy (MW)	1,667
Biofuels	2% of national liquid fuel supply by 2012

#### DISTRIBUTION OF INVESTMENT, BY SECTOR (2005-09)



#### KEY INVESTMENT INCENTIVES

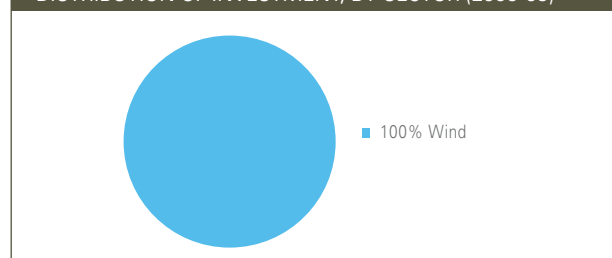
Wind, Solar, Small-Hydro	Feed-in tariffs
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#### NATIONAL CLEAN ENERGY POLICIES

Carbon Cap	
Carbon Market	
Renewable Energy Standard	
Clean Energy Tax Incentives	
Auto Efficiency Standards	
Feed-in Tariffs	✓
Government Procurement	
Green Bonds	

Although it has clean energy ambitions, South Korea's small \$20 million worth of investment in 2009 earned it 19th place among G-20 members, just ahead of Russia and Saudi Arabia which have only negligible investments. South Korea has 660 megawatts of wind and solar, but it aims to add 3 GW by 2011, at which time it plans to obtain 5 percent of all energy production from renewables. In relative terms, South Korea's \$27.8 billion clean energy stimulus package is one of the G-20's most significant.

#### DISTRIBUTION OF INVESTMENT, BY SECTOR (2005-09)



#### NATIONAL CLEAN ENERGY POLICIES

Carbon Cap	
Carbon Market	✓
Renewable Energy Standard	✓
Clean Energy Tax Incentives	✓
Auto Efficiency Standards	✓
Feed-in Tariffs	✓
Government Procurement	
Green Bonds	✓

#### FINANCE AND INVESTMENT (2009)

Total Investment	\$20 million
G-20 Investment Rank	19
Percentage of G-20 Total	0.02%
5-Year Growth Rate	N/A

#### INSTALLED CLEAN ENERGY (2009)

Total Renewable Energy Capacity	0.7 GW
Total Power Capacity	0.8%
Percentage of G-20 Total	0.3%
5-Year Growth Rate	249.4%
Key Renewable Energy Sectors	
Solar	356 MW
Wind	304 MW

#### KEY CLEAN ENERGY TARGETS (2011)

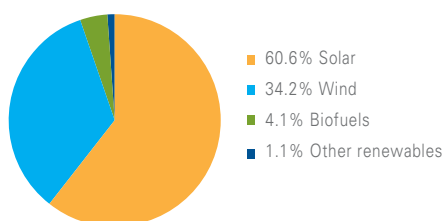
Wind	2,250 MW
Solar	1,300 MW

#### KEY INVESTMENT INCENTIVES

Wind, Biomass, Small-Hydro	Generation-based subsidies
Renewable Energy Manufacturing	KEMCO long-term loan for manufacturing facilities

Spain, although not an individual member, is associated with the G-20 through its membership in the European Union. In view of its significant clean energy investments—\$10.4 billion in 2009—it is profiled for its leadership, and earned a ranking of fifth among G-20 members for overall investment. Spain's 2009 investment was down more than 50 percent from 2008 due to the global financial crisis and Spain's budget difficulties. Wind and solar have been the primary areas of investment backed by strong national support in the form of feed-in tariffs. Continued budget pressure jeopardizes ongoing renewable energy incentives.

DISTRIBUTION OF INVESTMENT, BY SECTOR (2005-09)



NATIONAL CLEAN ENERGY POLICIES

Carbon Cap	
Carbon Market	✓
Renewable Energy Standard	✓
Clean Energy Tax Incentives	✓
Auto Efficiency Standards	
Feed-in Tariffs	✓
Government Procurement	✓
Green Bonds	

FINANCE AND INVESTMENT (2009)

Total Investment	\$10.4 billion
G-20 Investment Rank	5
Percentage of G-20 Total	9.2%
5-Year Growth Rate	79.7%

INSTALLED CLEAN ENERGY (2009)

Total Renewable Energy Capacity	22.4 GW
Total Power Capacity	30.1%
Percentage of G-20 Total	N/A*
5-Year Growth Rate	9.1%
Key Renewable Energy Sectors	
Wind	16,740 MW
Solar	3,604 MW
Biomass	483

KEY CLEAN ENERGY TARGETS (2011)

Renewable Energy	12% of total energy consumption
Biofuels	7% of total fuel consumption

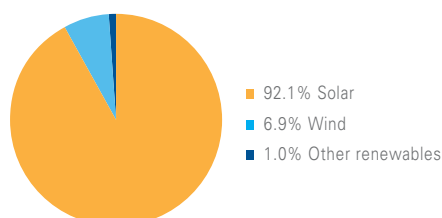
KEY INVESTMENT INCENTIVES

Wind, Solar, Biomass	Feed-in tariffs
Biomass Co-generation	Preferential loans of up to 1.5 million euros
Biofuels	Exempt from hydrocarbon tax until 2012

\*Spain is not a G-20 member, but it is an important clean energy player within the European Union.

Turkey's five-year investment growth rate is the highest in the G-20, but its clean energy economy is small. Its 2009 investment of \$1.6 billion earned it 13th place in the G-20. Wind is the leading clean energy source in Turkey. A renewable energy law that guarantees feed-in tariffs for renewable power is under consideration, offering the possibility of Turkey becoming a key destination for clean energy investments. Turkey also has an ambitious target to source 25 percent of all its energy needs from renewables by 2020.

DISTRIBUTION OF INVESTMENT, BY SECTOR (2005-09)



## NATIONAL CLEAN ENERGY POLICIES

Carbon Cap	
Carbon Market	
Renewable Energy Standard	✓
Clean Energy Tax Incentives	✓
Auto Efficiency Standards	
Feed-in Tariffs	✓
Government Procurement	✓
Green Bonds	

## FINANCE AND INVESTMENT (2009)

Total Investment	\$1.6 billion
G-20 Investment Rank	13
Percentage of G-20 Total	1.4%
5-Year Growth Rate	178.3%

## INSTALLED CLEAN ENERGY (2009)

Total Renewable Energy Capacity	0.6 GW
Total Power Capacity	0.4%
Percentage of G-20 Total	0.1%
5-Year Growth Rate	29.6%
Key Renewable Energy Sectors	
Small-hydro	127 MW
Wind	433 MW

## KEY CLEAN ENERGY TARGETS (2011)

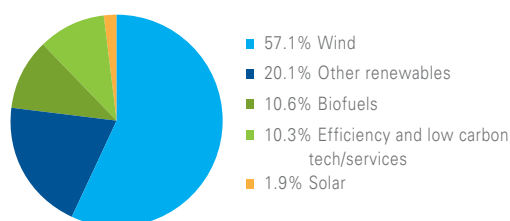
Wind	15,000 MW
Renewable Energy	25% of energy consumption by 2020

## KEY INVESTMENT INCENTIVES

Wind, Solar, Geothermal	25% of generation by 2020
Wind	Equipment exempt from VAT and customs duty

Nearly 10 percent of G-20 clean energy investment in 2009 occurred in the United Kingdom, earning it third place. The United Kingdom has been focused primarily on wind energy, with major funding directed toward the development of offshore wind power. Its targets include procuring 20 percent of its electricity and 10 percent of its fuel needs from renewables by the end of 2010. The United Kingdom's renewable energy standard allows trading of permits.

DISTRIBUTION OF INVESTMENT, BY SECTOR (2005-09)



## NATIONAL CLEAN ENERGY POLICIES

Carbon Cap	
Carbon Market	✓
Renewable Energy Standard	✓
Clean Energy Tax Incentives	✓
Auto Efficiency Standards	✓
Feed-in Tariffs	✓
Government Procurement	✓
Green Bonds	✓

## FINANCE AND INVESTMENT (2009)

Total Investment	\$11.2 billion
G-20 Investment Rank	3
Percentage of G-20 Total	9.9%
5-Year Growth Rate	127.4%

## INSTALLED CLEAN ENERGY (2009)

Total Renewable Energy Capacity	7.5 GW
Total Power Capacity	8.4%
Percentage of G-20 Total	2.8%
5-Year Growth Rate	29.8%
Key Renewable Energy Sectors	
Wind	4,000 MW
Biomass	484 MW

## KEY CLEAN ENERGY TARGETS (2010)

Renewable Energy Electricity	Procure 20% of electricity from renewable energy
Biofuels	10% of total fuel consumption

## KEY INVESTMENT INCENTIVES

Renewable Energy Electricity	Renewable energy exempt from £4.3/ MWh climate change levy
Renewable Energy	Renewable energy standard, with permit trading
Biofuels	Mandatory procurement of 3.5% of all fuel consumption from biofuels through Renewable Transport Fuel Obligation





The United States dropped to second place among G-20 members with a total investment of \$18.6 billion, down 42 percent from 2008 levels. Tight credit and lack of a strong national policy framework constrain more robust investment. Also, ethanol investments that fueled progress in 2006 and 2007 waned in 2008 and 2009. However, next generation biofuels, energy efficiency and the smart grid saw investment gains. The 2009 enactment of long-term production tax credits (wind) and investment tax credits (solar) helped salvage what could have been a disastrous year for U.S. clean energy investments. U.S. clean energy investments are poised to climb in 2010, when one-third of the clean energy stimulus funding is due to be spent. The United States continues to dominate venture finance and technology innovation, but it lags in manufacturing.

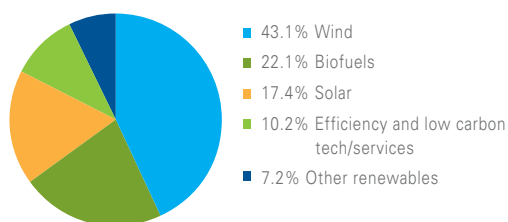
#### FINANCE AND INVESTMENT (2009)

Total Investment	\$18.6 billion
G-20 Investment Rank	2
Percentage of G-20 Total	16.4%
5-Year Growth Rate	102.7%

#### INSTALLED CLEAN ENERGY (2009)

Total Renewable Energy Capacity	53.4 GW
Total Power Capacity	4.0%
Percentage of G-20 Total	18.5%
5-Year Growth Rate	24.3%
Key Renewable Energy Sectors	
Ethanol	47 m liters
Wind	31,900 MW

#### DISTRIBUTION OF INVESTMENT, BY SECTOR (2005-09)



#### NATIONAL CLEAN ENERGY POLICIES

Carbon Cap	
Carbon Market	
Renewable Energy Standard	
Clean Energy Tax Incentives	✓
Auto Efficiency Standards	✓
Feed-in Tariffs	
Government Procurement	✓
Green Bonds	

#### KEY CLEAN ENERGY TARGETS (2022)

Biofuels	36 billion gallons
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#### KEY INVESTMENT INCENTIVES\*

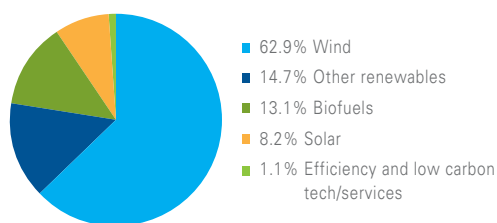
Wind, Solar	Production Tax Credit / Investment Tax Credit
Cleantech	Federal loan guarantees
Wind, Solar, Power Storage	Federal Manufacturers Tax Credit

\*Incentives provided by local, state and federal governments.



The EU countries not profiled independently in this report accounted for \$10.8 billion worth of clean energy investments in 2009, making this group fourth overall among the G-20. These nations have a total installed renewable energy capacity of 12.3 GW. The European Union has strong community-wide targets, including 10 percent of electricity produced from renewable sources by 2010 and 5 percent of fuel consumption from biofuels by 2020. The European Union's community-wide carbon and energy policies encourage clean energy investments throughout the region.

DISTRIBUTION OF INVESTMENT, BY SECTOR (2005-09)



NATIONAL CLEAN ENERGY POLICIES

Carbon Cap	✓
Carbon Market	✓
Renewable Energy Standard	✓
Clean Energy Tax Incentives	✓
Auto Efficiency Standards	✓
Feed-in Tariffs	✓
Government Procurement	✓
Green Bonds	✓

FINANCE AND INVESTMENT (2009)

Total Investment	\$10.8 billion
G-20 Investment Rank	4
Percentage of G-20 Total	9.5%
5-Year Growth Rate	87%

INSTALLED CLEAN ENERGY (2009)

Total Renewable Energy Capacity	12.3 GW
Total Power Capacity	4.5%
Percentage of G-20 Total	6.7%
5-Year Growth Rate	17.2%

Key Renewable Energy Sectors

Wind	N/A
Solar	N/A
Biomass	N/A

KEY CLEAN ENERGY TARGETS

Renewable Power	10% of total electricity consumption by 2010
Biofuels	5% of total fuel consumption by 2020

KEY INVESTMENT INCENTIVES

Portugal	Green certificates, preferential loans, investment grants
Greece	Feed-in tariffs, tax incentives
Netherlands	Green premiums, investment subsidies

\* Does not include data for Spain.

## APPENDIX: METHODOLOGY

All figures in this report, unless otherwise credited, are based on the output of the Desktop database of Bloomberg New Energy Finance, an online portal to the world's most comprehensive database of investors, projects and transactions in clean energy. Data are categorized by country. Members of the European Union not profiled individually here are aggregated as "Rest of the EU-27."<sup>4</sup>

The Bloomberg New Energy Finance Desktop collates all organizations, projects and investments according to transaction type, sector, geography and timing. It covers 11,000 transactions, 20,000 projects and 30,000 organizations (including start-ups, corporations, venture capital and private equity providers, banks and other investors).

Research included the following renewable energy projects: all biomass, geothermal and wind generation projects of more than 1 megawatt, all hydro projects of between 0.5 and 50 megawatts, all solar projects of more than 0.3 megawatts, all marine energy projects, and all biofuel projects with a capacity of 1 million liters or more per year.

Annual investment in small scale and residential projects, such as micro wind turbines, solar water heaters and bio-digesters, is estimated. These estimates are based on annual installation data, provided by industry associations and REN21.<sup>5</sup>

Energy efficiency investment includes financial investment in technology companies plus corporate and government investment in R&D. It excludes investment in energy efficiency projects by governments and public financing institutions. Where deal values are not disclosed, Bloomberg New Energy Finance assigned an estimated value based on comparable transactions. Deal values are rigorously rechecked and updated when further information is released about particular companies and projects. The statistics used are historic figures, based on confirmed and disclosed investment.

Bloomberg New Energy Finance continuously monitors investment in renewable energy and energy efficiency. This is a dynamic process. As the sector's visibility grows, information flow improves. New deals come to light and existing data are refined, meaning that historical figures are constantly updated. The data published in this report are current as of March 2010.

<sup>4</sup> The "Rest of the EU-27" category includes Austria, Belgium, Bulgaria, Cyprus, the Czech Republic, Denmark, Estonia, Finland, Greece, Hungary, Ireland, Latvia, Lithuania, Luxembourg, Malta, The Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia and Sweden.

<sup>5</sup> REN21 is an independent, international nongovernmental organization that chronicles renewable energy trends around the world and connects governments, industry, organizations and others to encourage rapid expansion of renewable energy worldwide.



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