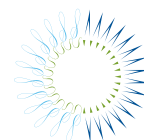


GLOBAL CLEAN POWER:

A \$2.3 Trillion Opportunity



Repowering Jobs, Businesses and Investments Across America



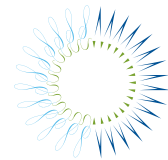
THE
PEW
CHARITABLE TRUSTS

GLOBAL CLEAN POWER:

A \$2.3 Trillion Opportunity



Repowering Jobs, Businesses and
Investments Across America



THE
PEW
CHARITABLE TRUSTS

THE PEW CHARITABLE TRUSTS

The Pew Charitable Trusts applies the power of knowledge to solve today's most challenging problems. Pew employs a rigorous, analytical approach to improve public policy, inform the public and stimulate civic life. We partner with a diverse range of donors, public and private organizations and concerned citizens who share our commitment to fact-based solutions and goal-driven investments to improve society. For additional information on The Pew Charitable Trusts, please visit www.PewTrusts.org.

THE PEW ENVIRONMENT GROUP

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

Joshua Reichert, Managing Director

Phyllis Cuttino, Project Director

David Catarious, Research Director

Gavin Feiger, Fellow

Laura Lightbody, Senior Associate

Jessica Frohman Lubetsky, Senior Associate

Brendan Reed, Associate

ABOUT THE REPORT

Global Clean Power: A \$2.3 Trillion Opportunity was developed for public informational and educational purposes. It examines scenarios for private investment in renewable energy assets in G-20 nations through 2020. This report is a follow-on to the Pew Charitable Trusts' March 2010 report *Who's Winning the Clean Energy Race? Competition and Opportunity in the World's Largest Economies*, which examined 2009 clean energy finance and investment in the countries that make up the Group of Twenty.¹ This research

complements ongoing efforts by the Pew Environment Group and the Pew Center on the States to chronicle the extent of jobs, businesses and investments in America's clean energy economy.

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 100 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 full description of the methodology and parameters employed for this report can be found in Appendix III.

ACKNOWLEDGMENTS

We are grateful to our research collaborators at Bloomberg New Energy Finance, led by Ethan Zindler, with Victoria Cumming, Manon Dufour and Krishnan Shakkottai. We would also like to thank our Pew colleagues - Tracy Schario, Brandon MacGillis, Kymberly Escobar, Peter Dykstra, Pete Janhunen and Shannon Pao - and Jonathan Rich of JCR Communications and the staff at Communications Inc. for their assistance with communications and dissemination. And we thank Kil Huh for his help in reviewing and advising on this report, Alziro Braga of Alziro Braga Graphic Design for his assistance, Juan Thomassie for his work in graphic assistance, and David Harwood of Good Works Group for his work in completing this report.

© 2010 The Pew Charitable Trusts

¹The Group of Twenty was established in 1999 to bring together leading industrialized and developing economies to discuss key global economic issues. 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. No data are provided for Russia and Saudi Arabia because clean energy investment there is negligible.

TABLE OF CONTENTS

Executive Summary	4
Section I	
Introduction and Background	10
Section II	
The Clean Energy Future: Investment Scenarios in G-20	14
Appendix I	
Key Clean Energy Policy Options	34
Appendix II	
Table: Copenhagen Pledges of Major Countries	34
Appendix III	
Methodology	38
Appendix IV - Country Profiles	
Argentina	40
Australia	42
Brazil	44
Canada	46
China	48
France	50
Germany	52
India	54
Indonesia	56
Italy	58
Japan	60
Mexico	62
South Africa	64
South Korea	66
Turkey	68
United Kingdom	70
United States	72
Rest of the European Union (Rest of EU-27)	74

TABLE OF FIGURES

Figure 1.	Global Average Temperatures and Correlating Expected Sea Level Rise	7, 27
Figure 2.	Global Investment in Clean Energy by Type, 2009	11
Figure 3.	Five-Year Growth in Investment, 2005	11
Figure 4.	Top 10 in Investment Intensity, 2009	11
Figure 5.	Investment by Financing Type, 2009 (billions of \$)	13
Figure 6.	Climate and Energy Policy Scenarios	14
Figure 7.	Investment in Renewable Energy Assets in G-20 Countries, 2010-20 (billions of \$)	16
Figure 8.	Current Policies: G-20 Leaders in Total 2020 Investment	18
Figure 9.	Current Policies: G-20 Leaders in Investment Growth, 2010-20	18
Figure 10.	Current Policies: G-20 Leaders in Cumulative Investments, 2010-20	18
Figure 11.	Current Policies: G-20 Renewable Energy Annual Additional Capacity Forecast (GW)	19
Figure 12.	Current Policies: G-20 Investment in Renewable Energy Assets (Billions of \$)	19
Figure 13.	Copenhagen Policies: G-20 Leaders in Total 2020 Investment	20
Figure 14.	Copenhagen Policies: G-20 Leaders in Investment Growth, 2010-20	20
Figure 15.	Copenhagen Policies: G-20 Leaders in Cumulative Investments, 2010-20	20
Figure 16.	Copenhagen Policies: G-20 Renewable Energy Annual Additional Capacity Forecast (GW)	21
Figure 17.	Copenhagen Policies: G-20 Investment in Renewable Energy Assets (Billions of \$)	21
Figure 18.	Enhanced Clean Energy Policies: G-20 Leaders in Total 2020 Investment	23
Figure 19.	Enhanced Clean Energy Policies: G-20 Leaders in Investment Growth, 2010-20	23
Figure 20.	Enhanced Clean Energy Policies: G-20 Leaders in Cumulative Investments, 2010-20	23

Figure 21.	Enhanced Clean Energy Policies: G-20 Investment in Annual Additional Capacity Forecast (GW)	24
Figure 22.	Enhanced Clean Energy Policies: G-20 Investment in Renewable Energy Assets (Billions of \$)	24
Figure 23.	Primary Investment Technology by Country, 2020	28
Figure 24.	Wind - Annual Investment in Renewable Energy Assets (Billions of \$)	30
Figure 25.	Solar - Annual Investment in Renewable Energy Assets (Billions of \$)	31
Figure 26.	Other Renewable Energy Technologies (Billions of \$)	32
Figure 27.	AUSTRALIA - Investment in Renewable Energy Assets, 2020 (Billions of \$)	43
Figure 28.	BRAZIL - Investment in Renewable Energy Assets, 2020 (Billions of \$)	45
Figure 29.	CANADA - Investment in Renewable Energy Assets, 2020 (Billions of \$)	47
Figure 30.	CHINA - Investment in Renewable Energy Assets, 2020 (Billions of \$)	49
Figure 31.	FRANCE - Investment in Renewable Energy Assets, 2020 (Billions of \$)	51
Figure 32.	GERMANY - Investment in Renewable Energy Assets, 2020 (Billions of \$)	53
Figure 33.	INDIA - Investment in Renewable Energy Assets, 2020 (Billions of \$)	55
Figure 34.	ITALY - Investment in Renewable Energy Assets, 2020 (Billions of \$)	59
Figure 35.	JAPAN - Investment in Renewable Energy Assets, 2020 (Billions of \$)	61
Figure 36.	SOUTH KOREA - Investment in Renewable Energy Assets, 2020 (Billions of \$)	67
Figure 37.	UNITED KINGDOM - Investment in Renewable Energy Assets, 2020 (Billions of \$)	71
Figure 38.	UNITED STATES - Investment in Renewable Energy Assets, 2020 (Billions of \$)	73
Figure 39.	REST OF EU-27 - Investment in Renewable Energy Assets, 2020 (Billions of \$)	75

EXECUTIVE SUMMARY

Over the last half-decade, the clean energy economy has emerged around the world as a major new opportunity for investment, manufacturing, jobs and environmental protection. This report explores scenarios for the dynamic expansion of electricity from renewable resources over the next decade.

The future trajectory of investments in clean power projects over the next decade will be determined by the strength of policies adopted by G-20 countries. If clean energy policies are strengthened significantly in the coming years, we project that \$2.3 trillion will be invested in clean power assets over the next 10 years, offering companies and countries enormous opportunities to compete for investments, jobs and export markets. Under current policies, however, cumulative investments would only reach \$1.7 trillion over the next decade. In other words, strong policies would leverage an additional \$546 billion worth of investment.

In all scenarios, clean energy power investments shift to Asia, led by dramatic increases in China and India. Still, all countries stand to gain from adoption of enhanced clean energy policies. The United States is a case in point as one of the three countries (along with India and the United Kingdom) that have the most to gain from adoption of aggressive clean energy policies, when enhanced policies are compared to current ones.

From an environmental perspective, current and Copenhagen policies (associated with pledges made at the 2009 Climate Summit) are insufficient - only enhanced clean energy policies will ensure that the power sector contributes to the scientific goal of curtailing global warming at 2 degrees Celsius.

The clean energy economy has emerged rapidly in recent years. The Pew Charitable Trusts' March 2010 report, *Who's Winning the Clean Energy Race? Growth, Competition and Opportunity in the World's Largest Economies*, chronicled the dawning of the global clean energy economy from 2005 to 2009. That report looked at 2009 investment totals and trends in the G-20 member nations, which together account for more than 90 percent of the world's clean energy finance and investment. Our first report found that clean energy investment increased by 230 percent from 2005 to 2009 to \$162 billion.

We found that China, for the first time, led the world in attracting clean energy investment and ranked at or near the top of all G-20 countries in nearly every measurement of clean energy growth. In contrast, the report found that the United States fell to second in the world in attracting clean energy investment and lagged behind other leaders on a variety of key metrics.

While our first report looked at past trends, *Global Clean Power: A \$2.3 Trillion Opportunity* examines three policy scenarios for future growth in clean energy investment, all of which present opportunities for the G-20 overall and for each nation comprising it.

The three scenarios modeled in this report are as follows:

Current Policies - This scenario assumes G-20 countries do not adopt any new climate or clean energy policies beyond those currently in effect.

Copenhagen Policies - This scenario assumes G-20 countries adopt and implement the policies required to meet pledges made pursuant to the United Nations Framework Convention on Climate Change Conference of the Parties (UNFCCC COP) in Copenhagen, Denmark, in 2009.

Enhanced Clean Energy Policies - This scenario assumes that G-20 countries pursue enhanced clean energy policies in order to further reduce greenhouse gas emissions and maximize clean energy investments.

These scenarios were developed in collaboration with Pew's research partner, Bloomberg New Energy Finance, the world's leading provider of data and analysis on clean energy finance and investment. For this report, Bloomberg New Energy Finance used its Global Energy and Emissions Model (GE²M) to project G-20 asset financing for renewable energy technologies used to generate electricity. Asset financing is associated with the construction/installation of clean energy equipment and generating capacity. This report looks exclusively at asset financing for wind, solar, biomass and energy from waste, small-hydro, geothermal and marine technologies because these investments can be reliably modeled into the future (unlike technology innovation or initial public offerings).² Unlike the first report, this study does not examine investments in biofuels or energy efficiency due to significant questions surrounding the reliability of production targets for the former and the challenge of quantifying the latter, as described in detail in Appendix III.

² Research included the following renewable energy projects: all biomass, geothermal and wind generation projects larger 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.

KEY FINDINGS

1. OPPORTUNITY ABOUNDS

All G-20 countries have an opportunity to attract more private investment in renewable energy assets by adopting strong clean energy policies. In turn, these investments will yield economic and environmental benefits in terms of increased jobs and reduced emissions of greenhouse gases. From 2010 to 2020, enhanced clean energy policies could increase annual investments in G-20 renewable energy assets by more than \$200 billion over 2010 levels, a 161 percent increase. In contrast, current and Copenhagen policies increase investment levels by a much more modest 46 and 64 percent above 2010 levels, respectively. Cumulatively, the enhanced clean energy policy scenario results in total investments in G-20 renewable energy assets of \$2.3 trillion - \$546 billion more than is projected under the current policy scenario.

The investment levels realized by individual members of the G-20 are not set in stone. With enhanced policies (e.g., strong renewable electricity standards, putting a price on carbon), countries can attract increased private investment in renewable energy projects. On average, enhanced clean energy investments will increase cumulative investments across the G-20 by more than 30 percent. Increased investment levels in the G-20, individually and collectively, present investment and economic opportunities for individuals and companies around the world. The private investments projected in this report are not tied to nations or boundaries - they are an opportunity for all. In today's integrated global marketplace, factories in one country are connected through supply chains with innovators, engineers and parts manufacturers in other countries. Companies that

create, produce and engineer clean energy goods and services have an opportunity to compete for business opportunities throughout the G-20.

2. ASIA LEADS THE WORLD IN CLEAN ENERGY INVESTMENTS BASED ON SURGING GROWTH IN CHINA AND INDIA

In 2010, Asia emerged as the top regional destination for clean energy finance and investment – a position that it is projected to maintain through 2020 thanks to the rapid investment growth in the region. Within the G-20, China, India, Japan and South Korea are projected to account for approximately 40 percent of clean energy project investments in 2020 under all three scenarios, with the Americas and Europe trailing. Asia's growth is driven in large part by increased demand. It is expected that 90 percent of future energy demand growth will come from developing countries over the next 20 years. Of that incremental energy demand growth, 53 percent is expected to come from China and India alone.³

China leads the way in attracting clean energy investments. Under the enhanced clean energy scenario, China could attract \$93 billion worth of clean energy asset financing in 2020. Cumulatively, in this scenario, \$620 billion is projected to be invested in renewable energy assets in China over the next 10 years. India is the other rising clean energy leader in Asia. While India ranked 10th in private clean energy investments among G-20 members in 2009, over the next 10 years it is expected to rise to third under all three 2020 scenarios modeled in this report. Annual clean energy investment in India is forecast to grow by as much as 763 percent between 2010 and

2020 under enhanced clean energy policies, and 369 percent under current policies.

3. THE UNITED STATES WOULD BENEFIT FROM STRONG CLEAN ENERGY POLICIES

While renewable energy asset financing is projected to rise in the United States under all scenarios, the United States would benefit from strong clean energy policies. If enhanced national clean energy policies were enacted, investment would ramp up to \$53 billion annually by 2020—a rise of 237 percent over 2010 levels. Under current and Copenhagen policies, investment rises 73 and 90 percent, respectively. Cumulatively, the United States has the potential to attract \$342 billion in private clean energy investments over the next decade. In fact, the United States is one of the three countries with the most to gain from adoption of aggressive clean energy policies, when enhanced policies are compared to current policies. The difference between cumulative investments in the current policies and enhanced clean energy policies scenarios for the United States is \$97 billion (40 percent). Only India and the United Kingdom, which could increase cumulative investments 48 percent under the enhanced policy scenario, have the potential to increase investments at a higher rate.

4. EUROPE'S CLEAN ENERGY ECONOMY MATURES

The European Union has the potential to increase cumulative investments by 20 percent to \$705 billion from 2010 to 2020 if the enhanced policy scenario is realized. Given its early leadership in clean energy

³ World Energy Outlook 2009 Fact Sheet, *Why is our current energy pathway unsustainable?* International Energy Agency, www.iea.org/weo/docs/weo2009/fact_sheets_WEO_2009.pdf.

development, it is expected that the European marketplace will mature in the coming decade, as investment in some of the early leaders declines and new entrants step forward. Growth opportunities are greatest for Southern Europe and offshore wind. Under all scenarios, over the next decade Europe falls behind Asia in renewable energy asset financing. Nonetheless, clean energy investments in Europe will remain sizable. Taken together, EU Member States are expected to attract \$56 billion in annual investments by 2020 under current policies, \$62 billion if Copenhagen pledges are met and \$85 billion if enhanced clean energy policies are pursued. In this scenario, investments in the United Kingdom increase by a robust 260 percent but fall in Germany and grow by less than 50 percent in France and Italy. In terms of cumulative investments over the next decade, Germany has the potential to realize more than \$208 billion worth of investment in the enhanced policy scenario, followed by the United Kingdom at \$134 billion and

Italy at \$90 billion. Strong European growth rates in the enhanced policies scenario occur in the other EU Member States, which collectively could see cumulative investments of \$216 billion from 2010-2020.

5. CLEAN ENERGY POLICIES REDUCE GREENHOUSE GAS EMISSIONS

Under all scenarios, increased investment helps to stem greenhouse gas emissions by G-20 members, which account for the overwhelming majority of global emissions. That said, only the enhanced clean energy policy scenario is consistent with the absolute reductions in greenhouse gas emissions by 2020 that scientists suggest are necessary to avoid global warming in excess of 2 degrees Celsius. In the current policies scenario, global carbon emissions increase by 24 percent over 2005 levels. Our modeling also shows that pledges made by nations in conjunction with the UNFCCC COP in Copenhagen (see Appendix II) have only a modest environmental impact - with

FIGURE 1. GLOBAL AVERAGE TEMPERATURES AND CORRELATING EXPECTED SEA-LEVEL RISE

Category	CO ₂ concentration at stabilization (2005 = 379 ppm)	CO ₂ equivalent concentration at stabilization including GHGs and aerosols (2005 = 375 ppm) ^b	Peaking year for CO ₂ emissions ^{a,c}	Change in global CO ₂ emissions in 2050 (percent of 2000 emissions)	Global average temperature increase above pre industrial at equilibrium, using "best estimate" climate sensitivity	Global average sea-level rise above pre industrial at equilibrium from thermal expansion only	Number of assessed scenarios
	ppm	ppm	year	percent	°C	meters	
I	350 – 400	445 – 490	2000 – 2015	-85 to -50	2.0 – 2.4	0.4 – 1.4	6
II	400 – 440	490 – 535	2000 – 2020	-60 to -30	2.4 – 2.8	0.5 – 1.7	18
III	440 – 485	535 – 590	2010 – 2030	-30 to +5	2.8 – 3.2	0.6 – 1.9	21
IV	485 – 570	590 – 710	2020 – 2060	+10 to +60	3.2 – 4.0	0.6 – 2.4	118
V	570 – 660	710 – 855	2050 – 2080	+25 to +85	4.0 – 4.9	0.8 – 2.9	9
VI	660 – 790	855 – 1130	2060 – 2090	+90 to +140	4.9 – 6.1	1.0 – 3.7	5

Source: *Climate Change 2007: Synthesis Report*, Intergovernmental Panel on Climate Change, www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr.pdf, p. 67.

global carbon emissions increasing 21 percent over 2005 levels in the next decade, not enough to stabilize concentrations at the level identified by the Intergovernmental Panel on Climate Change (IPCC) to avert far-reaching effects of climate change. But emissions in the enhanced policy scenario are just over 44 gigatons of carbon equivalent, the level that the United Nations Environment Programme recently estimated⁴ as consistent with the goal of keeping global warming below 2 degrees, as Figure 1 presents.

6. RENEWABLE ENERGY CAPACITY ADDITIONS COULD EXCEED 177 GIGAWATTS ANNUALLY BY 2020

All clean energy technologies will be deployed in increasing quantities over the next 10 years. Under the enhanced clean energy policies scenario, annual renewable energy capacity additions could exceed 177 gigawatts (GW) by 2020. Collectively, the G-20 could see cumulative capacity additions of 1,180 gigawatts over the next decade if the enhanced policy scenario is realized.



© Rodion | Shutterstock.com

WIND

Wind energy is projected to be the leading recipient of asset financing through 2020, reflecting its status as a relatively mature and cost-competitive large-scale clean energy technology. Under the enhanced clean energy scenario, asset financing in wind power escalates to \$190 billion—an increase of 222 percent over 10 years. Wind accounts for more than 50 percent of China's investments in each scenario.



© Lucarelli | Temistocle | Shutterstock.com

SOLAR

Solar accounts for the second-largest share of asset financing in G-20 countries and maintains this position under all scenarios, retaining a fairly constant 18 percent share of total renewable energy investment. That said, the value of solar investments is projected to decline under the current and Copenhagen policy scenarios because increased sales are unlikely to keep pace with the rapid decline in prices for solar panels. Under the enhanced policies scenario, solar investments increase by 53 percent.



© Paul Topp | Dreamstime.com

OTHER RENEWABLE ENERGY TECHNOLOGIES

The good news for biomass, geothermal, waste energy and small-hydro power is that, collectively, investment levels in this category rise more than wind and solar if countries implement more ambitious clean energy policies. Overall, investment could grow by 263 percent to \$69 billion in 2020 under the enhanced policy scenario. Biomass and energy from waste, and small-hydro receive the most financing, while comparatively little is spent on geothermal and marine technologies.

⁴ United Nations Environment Program, "Are the Copenhagen Pledges Sufficient to Limit Global Warming to 2° C or 1.5° C? A Preliminary Assessment." November 2010, p. 4, www.unep.org/publications/ebooks/emissionsgapreport/pdfs/EMISSIONS_GAP_TECHNICAL_SUMMARY.pdf

7. POLICY MATTERS

The extraordinary worldwide growth in clean energy investment over the past five years has been defined by a simple fact: Where supportive clean energy policies are adopted, investment follows. Time and again, it has been shown that nations with the strongest policy frameworks have attracted the most capital and enjoyed the associated economic benefits, including job creation. In today's integrated global economy, no country or company can develop a monopoly on clean energy production. Growth in the clean energy sector creates jobs up and down the supply chain - from engineering to shipping - and market expansion can benefit workers and businesses all over the world.

If G-20 countries do not implement any further policies, investment in renewable energy assets is projected to reach \$189 billion by 2020—a modest 46 percent above 2010 levels. If those same nations implement their pledges made in Copenhagen, financing grows incrementally to \$212 billion—growth of 64 percent over 2010. However, if comprehensive and effective measures are introduced to maximize a nation's share of the global clean energy economy, investment could reach \$337 billion annually in 2020—an increase of 161 percent compared with 2010 investments in renewable energy assets.

© Bernhard Richter | Dreamstime.com



These impressive investment levels reveal the enormous potential for nations to benefit from renewable energy investment growth over the next decade if countries adopt enhanced energy and climate policies. It is clear from the research that neither current policies nor the emission-reduction targets pledged by member nations under the Copenhagen Accord in January 2010 are sufficient to maximize renewable energy investment or to meet worldwide goals for curbing global warming.

In March 2010, The Pew Charitable Trusts released *Who's Winning the Clean Energy Race? Growth, Competition and Opportunity in the World's Largest Economies*, which documented the rapid growth in clean energy investment from 2005 to 2009 among the members of the G-20. Overall investments in clean energy grew 230 percent in that period. We found that the clean energy sector weathered the worldwide recession relatively well, declining by only 6.6 percent from 2008 to 2009. In 2009, \$162 billion⁵ was invested in clean energy globally,⁶ with more than 90 percent of that investment occurring in G-20 member nations. And the future of the clean energy sector is bright. Worldwide, clean energy investments are forecast to grow by as much as 25 percent by in 2010 over the previous year's investments.

China established itself as the world's clean energy powerhouse in 2009, attracting investments totaling more than \$34 billion. This was the first time that China assumed the top spot in global clean energy investment. Its ascendance as the top destination for clean energy finance tracks with its 150 percent growth in investment from 2005 to 2009. The United States, with \$18.6 billion worth of investments (down 40 percent from 2008), was a distant second as a destination for clean energy investments in 2009. While the United States continues to

lead the world in venture capital investments, it trails other G-20 leaders in the category of asset financing. In other words, the United States leads in innovation but lags in project development.

HISTORICAL TRENDS IN CLEAN ENERGY INVESTMENT

The remarkable ascendance of clean energy finance and investment has reverberated across three key regions over the past decade - Europe, the Americas and Asia. Europe was the clean energy trailblazer, thanks to early adoption of strong clean energy and climate policies. As a result, private clean energy investments in Europe were averaging approximately \$50 billion a year until 2009, when the level slipped 10 percent as the worldwide recession and a yearlong global credit squeeze curtailed investment levels. The Americas, led by the United States and Brazil, emerged as a high-growth destination for private-sector investment in clean energy as oil prices rose from 2006 to 2008. Policy responses in the United States and Brazil helped spur investments across the Americas to an all-time high of \$49 billion in 2008. The story of the past two years, from 2007 to 2009 has been the impressive growth in clean energy investments in Asia. Clean energy investments surged 73 percent over that time to \$41 billion. More than three-quarters of this investment has occurred in China, but funds have also flowed into South Korea, Japan and elsewhere. In 2010, for the first time since 2004, Asia will become the top destination for clean energy investments. China has emerged as the world's clean energy leader, with India rising rapidly.

⁵ All monetary values are United States dollars unless otherwise noted.

⁶ Includes all categories of clean energy investment and all countries

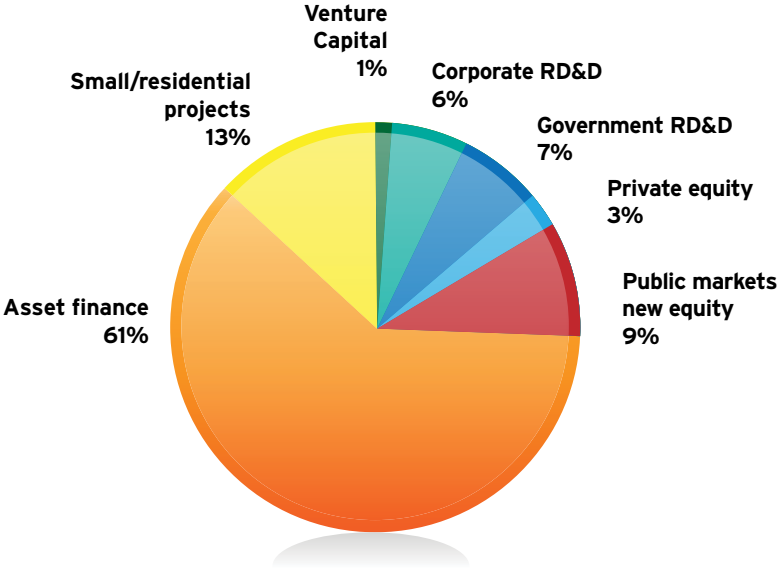
The extraordinary worldwide growth in clean energy investment between 2005 and 2009 has corresponded with adoption of supportive national policies. Nations with the strongest policy frameworks have attracted the most capital and enjoyed the associated economic benefits, including job creation. Still, in today's integrated global marketplace, companies in one part of the world can prosper from orders and investments that originate in other nations.

Presently, G-20 countries with the most robust policy frameworks (China, Germany and Brazil, for example) appear

to have the strongest clean energy sectors relative to the size of their economies, while those with weaker policy frameworks (such as the United States, Australia and Japan) lag behind.

If our first report was a snapshot in time, this report, also undertaken in collaboration with Bloomberg New Energy Finance, is a vision of the next decade, in which policy shapes the clean energy future through 2020. Under all three scenarios modeled in this report, our research projects that aggressive clean energy policies could leverage significant private investments in the future. The more ambitious the

FIGURE 2. GLOBAL INVESTMENT IN CLEAN ENERGY BY TYPE, 2009



Notes: Total values include estimates for undisclosed deals. Data for small distributed capacity based on estimates from various industry sources.

FIGURE 3. FIVE-YEAR GROWTH IN INVESTMENT, 2005-09

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 4. TOP 10 IN INVESTMENT INTENSITY, 2009

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%

SECTION I. INTRODUCTION AND BACKGROUND

policies, the more significant the private investment levels realized by the G-20 as a group and every nation individually.

Specifically, should G-20 countries implement policies that maximize clean energy capacity and reduce greenhouse gas emissions, cumulative private investment in renewable energy assets is projected to total \$2.3 trillion over the next 10 years, \$546

billion more than under current policies. On an annual basis, G-20 investments increase 161 percent from 2010 to an estimated \$337 billion in 2020. Conversely, if no new clean energy policies are introduced in G-20 nations, annual investment in renewable energy assets will rise, but only to \$189 billion in 2020, or 46 percent above 2010 investment levels.

TYPES OF CLEAN ENERGY INVESTMENTS

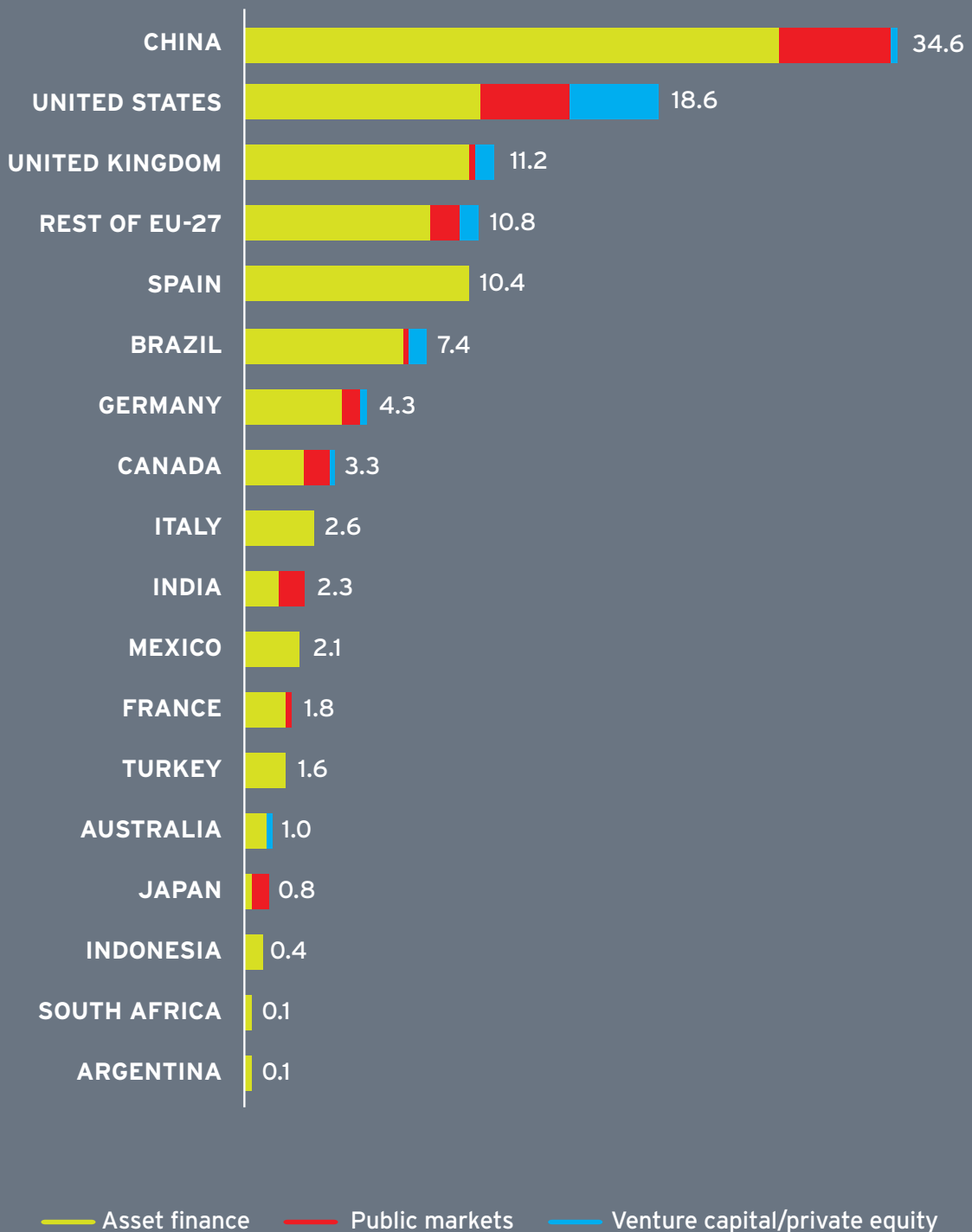
Who's Winning the Clean Energy Race? Growth, Competition and Opportunity in the World's Largest Economies tracked 2009 clean energy investments across the financing spectrum in three categories:

ASSET FINANCING - This category includes all money invested in renewable energy generation projects, whether from international company balance sheets, debt finance or equity finance. It excludes refinancing and short-term construction loans. Asset financing typically is associated with the construction/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 technologies. In general, venture capital is invested in the innovation stage, when companies are proving the market potential of goods and services.

FIGURE 5. INVESTMENT BY FINANCING TYPE, 2009 (BILLIONS OF \$)



This report tracks private investment in renewable energy assets across the G-20 countries under three clean energy scenarios between 2010 and 2020. For this report, Bloomberg New Energy Finance used its Global Energy and Emissions Model (GE²M) and industry expertise to project G-20 financing for renewable energy technologies used to generate electricity. Harnessing these

capabilities, Pew was able to project 2020 levels of renewable energy asset financing in key G-20 nations and the G-20 overall under three policy scenarios: current policy, Copenhagen policy, and enhanced clean energy policy.

We spotlight private investment because it represents the majority of the capital mobilized globally for clean energy deployment. Moreover, the private sector

FIGURE 6. CLIMATE AND ENERGY POLICIES SCENARIOS

CURRENT POLICIES

This scenario describes what would happen if national governments implement only existing policies to promote renewable energy and reduce carbon dioxide (CO₂) emissions—i.e., if the status quo is maintained. It does not include policies under consideration, potential future policies or targets devoid of implementation measures. Trends in population, the economy, technology, human behavior and policy are all assumed to continue.

Also incorporated are projections of new clean energy capacity added as technologies improve and equipment prices drop. For instance, a projected decline in the price of solar photovoltaic panels will eventually mean that solar installations are driven not by policy requirements or subsidies but by pure economics.

While each country attains different levels, under this scenario renewable energy accounts for 22.8 percent of overall power generation across the G-20.

COPENHAGEN POLICIES

Following the 15th annual United Nations Framework Convention on Climate Change Conference of the Parties (UNFCCC COP) held in Copenhagen, Denmark, in 2009, 81 countries submitted commitments and pledges under the Copenhagen Accord. This scenario assumes that governments adhere to the commitments to cut emissions they made in Copenhagen. Those pledges alone are far too general to support an investment forecast, however. In many cases, they represent little more than a promise to cut emissions by certain levels.

This scenario, assumes that countries put in place specific clean energy policies that would allow them to achieve their emissions goals. In countries where such policies were under consideration but had not received final approval, it was assumed that they would in fact be adopted. In countries that did not have specific clean energy policies on the table to comply with Copenhagen, it was assumed such policies were adopted. Finally, it was assumed that these new policies would not place the onus of carbon reduction any more heavily on the power-generating sector than on other sectors of an economy.

Under this scenario, although each country attains its own level, under this scenario renewable energy accounts for 23 percent of overall power generation across the G-20.

is uniquely capable of mobilizing financial resources consistently and at a scale to meet the world's economic, energy independence and environmental objectives. Government funding plays a key role in energy research and development around the world and can be a catalyst in clean energy deployment. But government's role is less as an investor and more as the creator of

a policy environment that allows the private sector to do what it does best - invest, innovate and create wealth. Creative, sound policies are critical to signal private investors that profitable and consistent opportunities exist in the clean energy marketplace. This report demonstrates that policies can make a significant difference in how much and where clean energy investment occurs.

Our research finds that the overall amount of asset finance in the G-20's renewable energy sector could range from \$189 billion in 2020 if no additional clean energy policies are adopted, to \$337 billion in 2020 if enhanced clean energy policies are adopted and implemented across the G-20. Cumulative private investment in renewable energy assets is projected to total \$2.3 trillion over

ENHANCED CLEAN ENERGY POLICIES

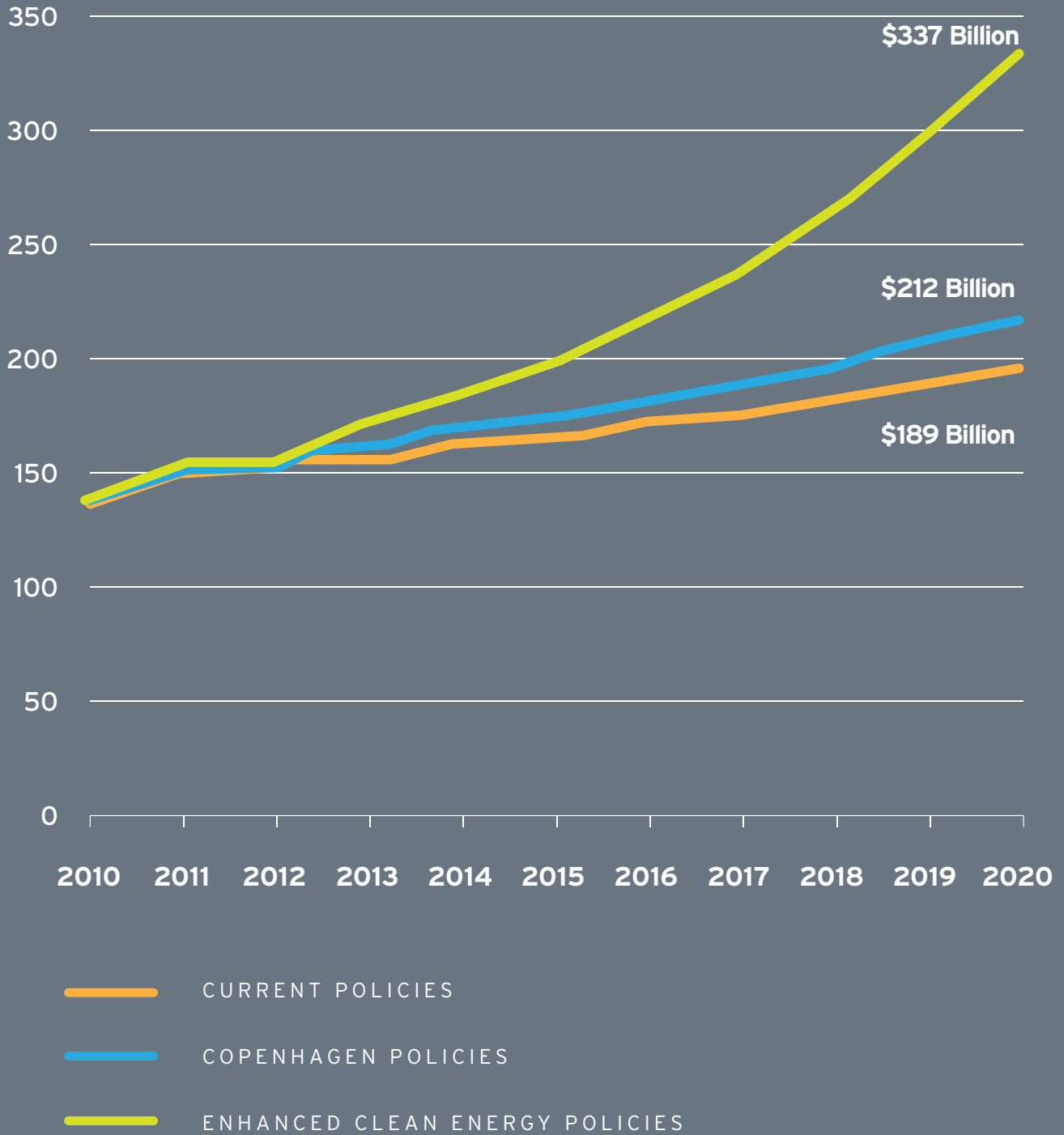
This scenario assumes that governments implement the most aggressive clean energy policies with an eye toward collectively cutting the amount of harmful greenhouse gases in the atmosphere to levels that reduce the risk of climate change, as determined by the IPCC. In some cases, the limiting factor on how much clean generation a country adds is the availability of natural resources and/or incumbent clean generation. Brazil, for instance, already meets 70 percent of its electricity needs via large-hydro projects that would not be displaced by new renewables. Germany could have as much as a third of its capacity from renewables by the end of 2010.

To foster a faster rate of clean energy growth, countries would adopt even more aggressive national targets than assumed in the Copenhagen scenario. That would result in higher levels of clean energy capacity added. In some cases, countries would max-out on the amount of renewables they add, given the variability of clean energy sources and the inherent limitations of the power grid. Under this scenario, it is assumed that G-20 members such

as the European Union that have adopted clean energy targets, would increase their percentage reduction of greenhouse gas emissions considerably to address climate change. However, it was generally not assumed that the energy sector would shoulder a larger share of cutting emissions than other CO₂-emitting sectors of the economy.

While each country attains different levels, under this scenario renewable energy accounts for more than 26 percent of overall power generation across the G-20.

FIGURE 7. INVESTMENT IN RENEWABLE ENERGY ASSETS IN G-20 COUNTRIES, 2010-20 (BILLIONS OF \$)



the next decade under the enhanced policy scenario, \$546 billion more than the current policy scenario.

Similarly, if enhanced clean energy policies are implemented, the G-20 power-sector is projected to contribute its fair share to the emissions reductions needed to achieve the objective of stabilizing greenhouse gas concentrations in the atmosphere at 450 parts per million (ppm). Under business as usual and Copenhagen policies, greenhouse gases in the atmosphere are very likely to exceed 500 ppm, and the prospect of more dangerous impacts for humans and ecosystems increases.

SCENARIO 1: CURRENT POLICIES

This scenario describes what happens if national governments implement only existing policies to promote renewable energy and reduce CO₂ emissions—i.e., if the status quo is maintained. It does not include policies under consideration, future policies or targets devoid of implementation measures. Trends in population, the economy, technology, human behavior and policy are all assumed to continue. Also incorporated are projections of new clean energy capacity added as technologies improve and equipment prices drop. For

instance, a projected decline in the price of solar photovoltaic panels will eventually mean solar installations are driven not by policy requirements or subsidies but by pure economics. Under this scenario, although each country attains its own level of clean energy generation, renewable energy accounts for 22.8 percent of overall power generation across the G-20.

Under the current policies scenario—i.e., no new renewable energy policies are adopted—G-20 investment in renewable energy assets are projected to increase 46 percent from the 2010 baseline of \$129 billion to \$189 billion in 2020. China maintains the leadership position it seized in 2009, with investment likely to increase 87 percent, from \$27 billion in 2010 to \$50 billion in 2020. The United States continues to rank as the 2nd global destination within the G-20 for clean energy investment, with a projected increase in annual investments of 73 percent, or \$27 billion, by 2020 - \$23 billion less than China. Under the current policy scenario, annual investment growth in 2020 increases most significantly in India and the United Kingdom, with growth rates of 369 percent and 171 percent, respectively, over 2010 levels. Australia is likely to double the clean energy investments it currently attracts by 2020.

FORECASTING METHODOLOGY

This report projects G-20 asset financing for renewable technologies used to generate electricity through 2020—including wind, solar (photovoltaic and solar thermal electricity generation), biomass and energy from waste, small hydro, geothermal and marine technologies.

Future forecasts are derived from the Bloomberg New Energy Finance Global Energy & Emissions Model (GE²M), an integrated fundamentals model covering all energy and emissions-intensive sectors around the world with consideration over time for dynamic economic, policy and behavioral factors.

For this report, GE²M has been put to use for one purpose: to project levels of deployment of renewable power generation in the future and to determine how many private sector dollars will be invested to make that so. Looking at the three policy scenarios described above, GE²M was used to forecast the number of new megawatts that would be added each year. Dollar estimates were then generated by multiplying total number of megawatts expected online in various scenarios by the projected dollar-per-megawatt costs of each of the key clean energy technologies. These costs were plotted into the future by Bloomberg New Energy Finance analysts based on their study and understanding of clean energy gleaned over five years of research.

A more detailed explanation of the methodology can be found in Appendix III: Key G-20 Member Nation's Copenhagen Pledges.

SECTION II. THE CLEAN ENERGY FUTURE: INVESTMENT SCENARIOS IN THE G-20

FIGURE 8. CURRENT POLICIES: G-20 LEADERS IN TOTAL 2020 INVESTMENT

COUNTRY	INVESTMENTS
China	\$50 billion
United States	\$27 billion
India	\$18 billion
United Kingdom	\$17 billion
Germany	\$12 billion

FIGURE 9. CURRENT POLICIES: G-20 LEADERS IN INVESTMENT GROWTH, 2010-20

COUNTRY	INCREASE IN INVESTMENTS
India	369%
United Kingdom	171%
Australia	162%
China	87%
Canada	77%

FIGURE 10. CURRENT POLICIES: G-20 LEADERS IN CUMULATIVE INVESTMENTS, 2010-20

COUNTRY	INVESTMENTS
China	\$471 billion
United States	\$245 billion
Germany	\$183 billion
India	\$118 billion
United Kingdom	\$114 billion
TOTAL G-20	\$1.75 TRILLION

In this scenario, cumulative investments across the G-20 countries total \$1.75 trillion over the next decade. China attracts cumulative investments of \$471 billion, followed by the United States at \$245 billion. The European Union as a whole attracts cumulative investments of \$592 billion over the period.

In the current policies scenario, annual G-20 country renewable energy capacity additions would increase by 59 percent

over 2010 levels - from 62 GW of wind, solar and other renewable energy capacity additions to 98 GW in 2020. Continuing its rapid pace of clean energy capacity additions, China's annual additional renewable energy capacity accounts for nearly 30 percent of the G-20 total capacity additions in 2020.

Cumulative renewable energy capacity additions for all G-20 nations total 895 GW over the next decade.

Power-sector greenhouse gas emissions in this scenario are not in line with levels needed to stabilize long-term atmospheric concentrations at 450 parts per million (ppm) - the level consistent with a global average temperature increase of 2 degrees Celsius - the threshold for more far-reaching and costly impacts associated with climate changes around the world.

FIGURE 11. CURRENT POLICIES – G-20 RENEWABLE ENERGY ANNUAL ADDITIONAL CAPACITY, FORECAST, 2010-20 (GW)

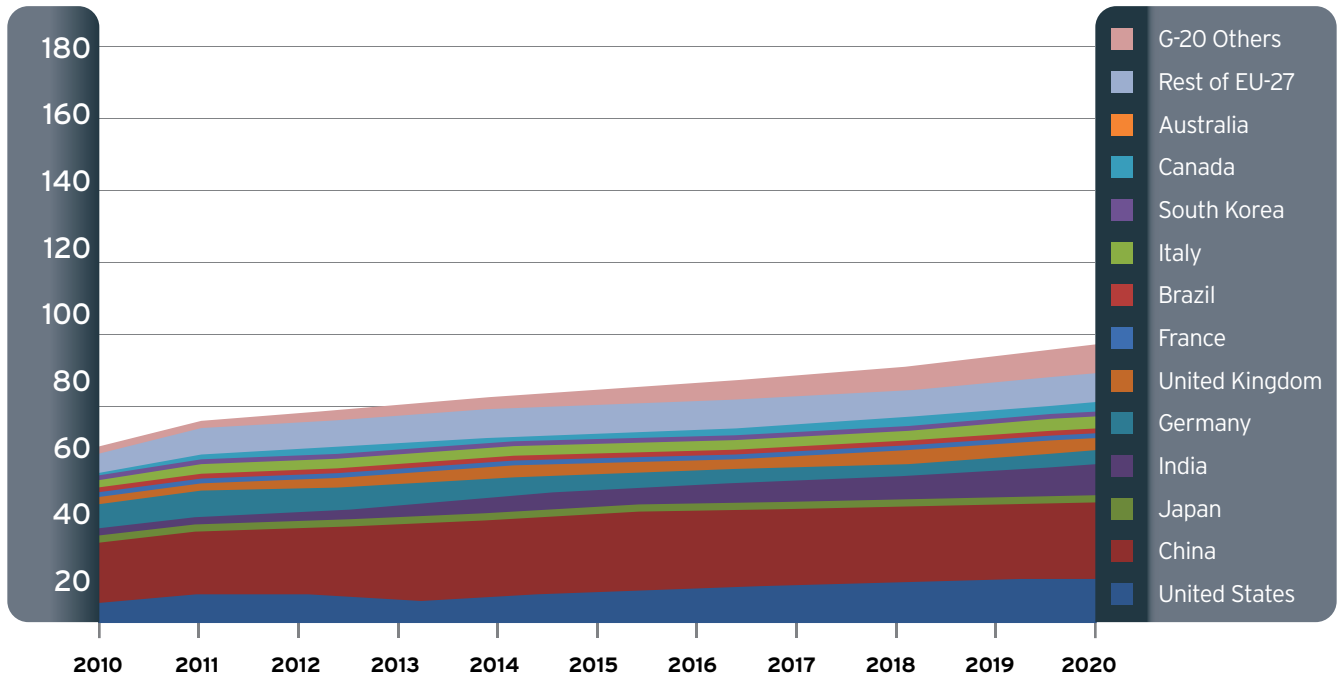
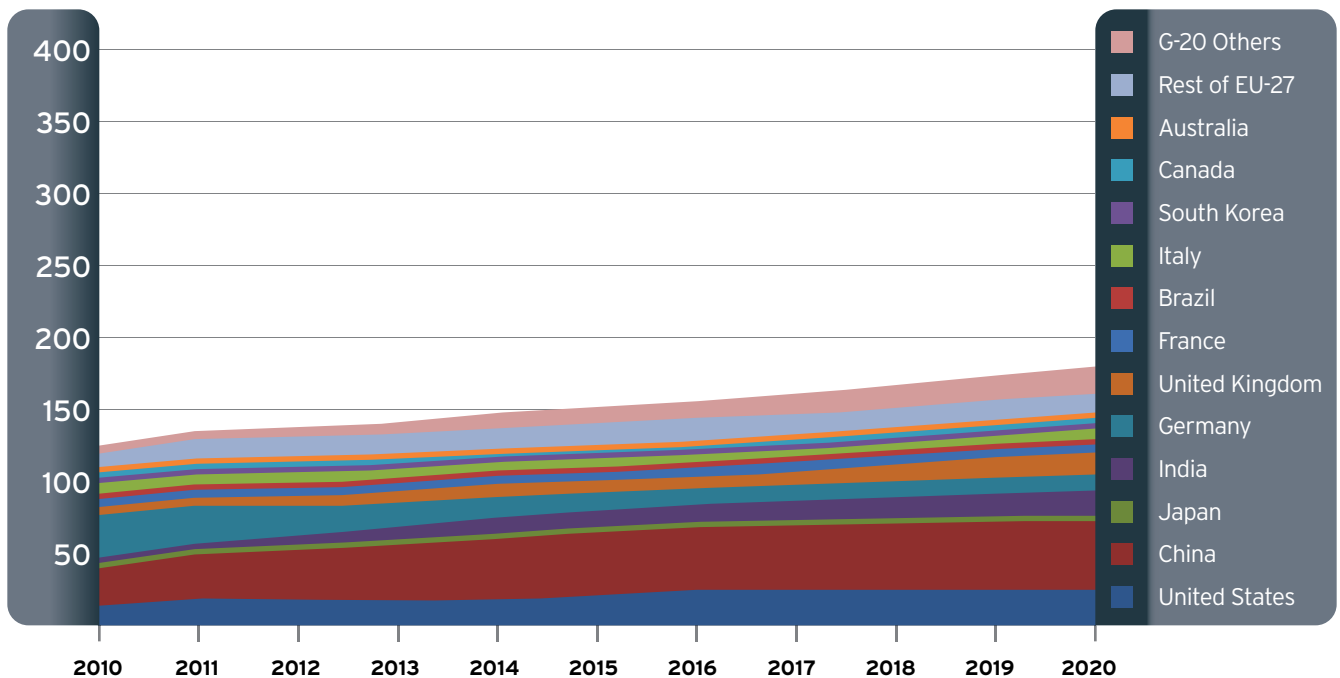


FIGURE 12. CURRENT POLICIES – G-20 INVESTMENT IN RENEWABLE ENERGY ASSETS, 2010-20 (BILLIONS OF \$)



SCENARIO 2 – COPENHAGEN POLICIES

In this scenario, governments around the globe adhere to the commitments to cut emissions they made in conjunction with the 2009 Copenhagen Accord. Those pledges alone are far too general to support an investment forecast, however. In many cases, they represent little more than a promise to cut emissions by certain levels. This scenario assumes that countries put in place specific clean energy policies that would allow them to achieve their emissions goals. In countries where such policies were under consideration but had not received final approval, it was assumed that they would be adopted. In countries that did not have specific clean energy policies on the table to comply with the Copenhagen Accord, it was assumed such policies were adopted. Finally, it

was assumed that these new policies would not place the onus of carbon reduction any more heavily on the power generating sector than on other sectors of a given economy. While each country attains different levels domestically, under this scenario, renewable energy under this scenario accounts for 23 percent of overall power generation across the G-20.

The model projects that G-20 nations' pledges and policies articulated pursuant to the Copenhagen Accord increase 2020 renewable energy asset financing in the G-20 by only 12 percent (\$23 billion) above levels associated with current policies. This suggests that pledges put forward at the 2009 climate summit in Copenhagen have only a modest impact on clean energy asset financing in the G-20. In this scenario,

clean energy investment in the G-20 countries rises 64 percent to \$212 billion in 2020. The countries with the most dramatic growth include India, up 416 percent to \$20 billion in 2020; the United Kingdom, up 198 percent to \$19 billion; Australia, up 188 percent, from less than \$1 billion to almost \$3 billion; and China, up 106 percent to \$55 billion, almost double the next-closest nation, the United States, which sees clean energy investments increase 90 percent to \$30 billion.

In this scenario, cumulative investments across the G-20 countries from 2010 to 2020 total \$1.86 trillion. China attracts cumulative investments of \$497 billion, followed by the United States at \$259 billion. The EU as a whole attracts cumulative investments of \$605 billion.

FIGURE 13. COPENHAGEN POLICIES: G-20 LEADERS IN TOTAL 2020 INVESTMENT

COUNTRY	INVESTMENTS
China	\$55 billion
United States	\$30 billion
India	\$20 billion
United Kingdom	\$19 billion
Germany	\$13 billion

FIGURE 14. COPENHAGEN POLICIES: G-20 LEADERS IN INVESTMENT GROWTH, 2010-20

COUNTRY	INCREASE IN INVESTMENTS
India	416%
United Kingdom	198%
Australia	188%
China	106%
Canada	95%

FIGURE 15. COPENHAGEN POLICIES: G-20 LEADERS IN CUMULATIVE INVESTMENTS, 2010-20

COUNTRY	INVESTMENTS
China	\$497 billion
United States	\$259 billion
Germany	\$190 billion
India	\$125 billion
United Kingdom	\$120 billion
TOTAL G-20	\$ 1.86 TRILLION

FIGURE 16. COPENHAGEN POLICIES – G-20 RENEWABLE ENERGY ANNUAL ADDITIONAL CAPACITY FORECAST, 2010-20 (GW)

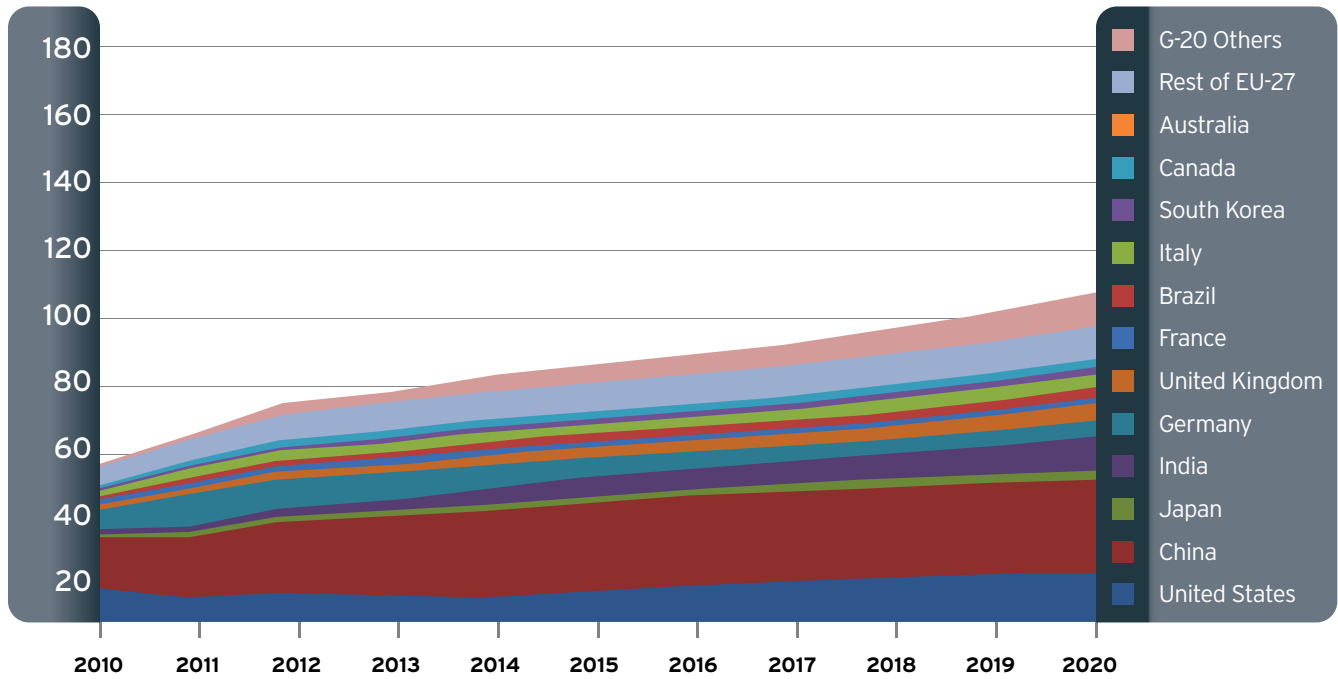
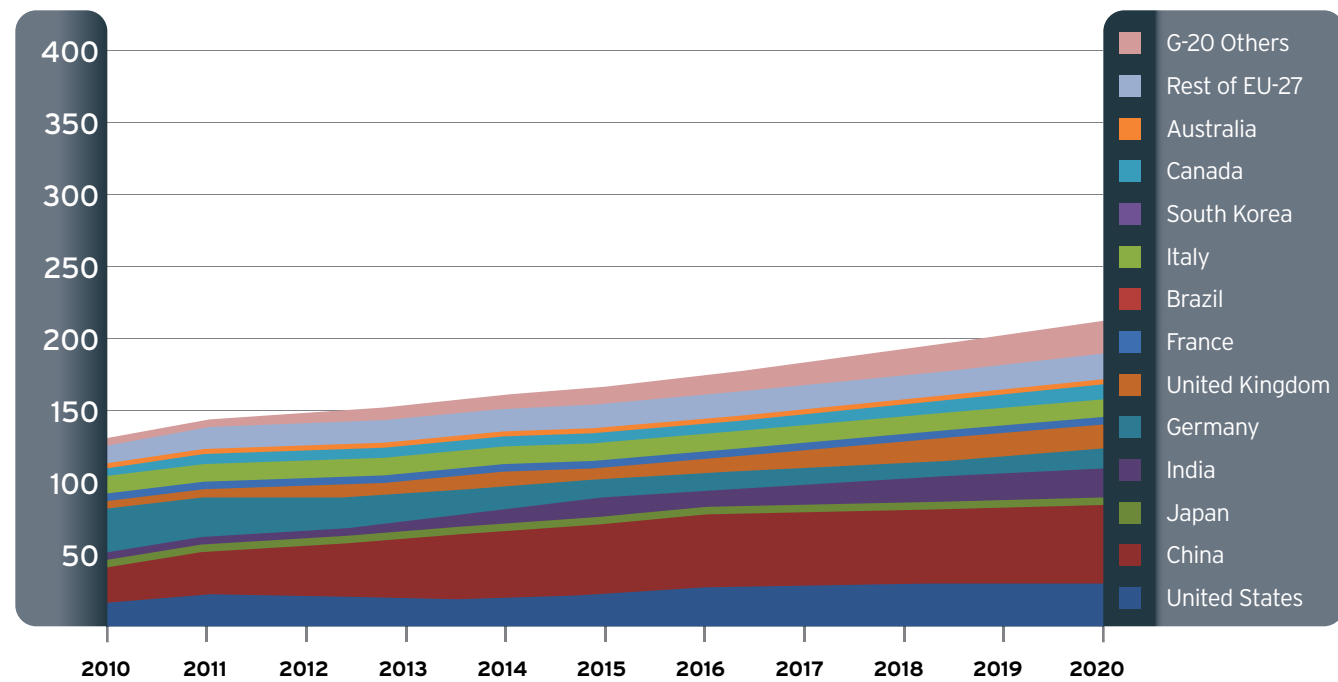


FIGURE 17. COPENHAGEN POLICIES – G-20 INVESTMENT IN RENEWABLE ENERGY ASSETS, 2010-20 (BILLIONS OF \$)



Under the Copenhagen policies scenario, renewable energy capacity additions are forecast to reach 109 GW in 2020. Cumulative capacity additions across the G-20 could total 949 GW over the next decade.

As with the current policies scenario, this scenario projects that power-sector emissions of greenhouse gas emissions exceed levels needed to stabilize long-term atmospheric concentrations at 450 ppm, meaning that there are likely to be more far-reaching and costly impacts associated with climate changes around the world.

SCENARIO 3 – ENHANCED CLEAN ENERGY POLICIES

This scenario assumes that governments implement the most aggressive clean energy policies with an eye toward collectively cutting the amount of harmful greenhouse gases in the atmosphere to levels that reduce the risk of climate change, as determined by the IPCC. In some cases, the limiting factor on how much clean generation a country adds is the availability of natural resources and/or incumbent clean generation. Brazil, for instance, already meets 70 percent of its electricity needs via large-hydro projects that would not be displaced by new renewable energy. Germany could have as much as a third of its capacity coming from renewable energy by the end of 2010.

To foster a faster rate of clean energy growth, countries would need to adopt

even more aggressive national targets than assumed in the Copenhagen scenario. That would result in higher levels of new clean energy capacity. The extent of enhanced policies will vary according to current levels of renewable energy penetration and other aspects of national circumstances. In almost all cases, enhanced policies will involve more ambitious national clean energy targets and some means of putting a price on carbon emissions. In some cases, countries would max-out on the amount of renewable energy they can add, given the variability of clean energy sources and the inherent limitations of the power grid. Under this scenario, it is assumed that countries that have adopted clean energy targets, such as the EU, would increase their overall emissions reductions considerably to address climate change. However, it was generally assumed that the energy sector would not shoulder a larger share of cutting emissions than other CO₂-emitting sectors of the economy (e.g., industry, land use, transportation). While each country attains its own level of renewable energy, under this scenario, renewable energy accounts for 26 percent of overall power generation across G-20 nations.

Overall G-20 asset financing in renewable technologies under the enhanced policies scenario increases in 2020 by 161 percent above 2010 levels, to \$337 billion. The 2020 investment levels are 79 percent above the current policies scenario and 60 percent above the Copenhagen policies level. The

FIGURE 18. ENHANCED CLEAN ENERGY POLICIES: G-20 LEADERS IN TOTAL 2020 INVESTMENT

COUNTRY	INVESTMENTS
China	\$93 billion
United States	\$53 billion
India	\$33 billion
United Kingdom	\$22 billion
Germany	\$18 billion

FIGURE 19. ENHANCED CLEAN ENERGY POLICIES: G-20 LEADERS IN INVESTMENT GROWTH, 2010-20

COUNTRY	INCREASE IN INVESTMENTS
India	763%
Australia	325%
United Kingdom	260%
China	246%
United States	237%

FIGURE 20. ENHANCED CLEAN ENERGY POLICIES: G-20 LEADERS IN CUMULATIVE INVESTMENTS, 2010-20

COUNTRY	INVESTMENTS
China	\$620 billion
United States	\$342 billion
Germany	\$208 billion
India	\$169 billion
United Kingdom	\$134 billion
TOTAL G-20	\$ 2.3 TRILLION

G-20 clean energy leader, China, would attract \$93 billion worth of clean energy project investments in 2020, a 246 percent increase over 2010. Clean energy investments increase by a staggering 763 percent in India, 325 percent in Australia, 260 percent in the United Kingdom and 237 percent in the United States, where 2020 investments total \$53 billion. As in the earlier scenarios, India's rapid growth places it third among G-20 nations, with \$33 billion worth of investments, followed by the United Kingdom (\$22 billion) and Germany (\$18 billion).

In this scenario, cumulative investments across G-20 countries over the next decade total \$2.3 billion. China attracts cumulative investments

of \$620 billion, followed by the United States at \$342 billion. The EU as a whole attracts cumulative investments of \$705 billion.

Implementation of enhanced clean energy policies could increase annual renewable energy capacity additions by almost 187 percent, from 62 GW added annually in 2010 to 177 GW added annually in 2020. This would mean that in 2020, G-20 nations could be adding renewable energy capacity each year equivalent to more than 50 percent of all the clean energy generating capacity in place today. Aggregate renewable energy capacity additions across the G-20 are forecast to total 1,180 GW over the next decade in this scenario.

An aggressive clean energy scenario also portends significant benefits for reducing greenhouse gas emissions. If enhanced clean energy policies are implemented, the power sector could contribute its fair share toward the emissions reductions needed to stabilize greenhouse gas concentrations in the atmosphere at 450ppm. Under current and Copenhagen policies, greenhouse gases in the atmosphere exceed 500ppm, and the prospect of dangerous impacts for humans and ecosystems increases.

SECTION II. THE CLEAN ENERGY FUTURE: INVESTMENT SCENARIOS IN THE G-20

FIGURE 21. ENHANCED CLEAN ENERGY POLICIES: G-20 INVESTMENT IN ANNUAL ADDITIONAL CAPACITY FORECAST (GW)

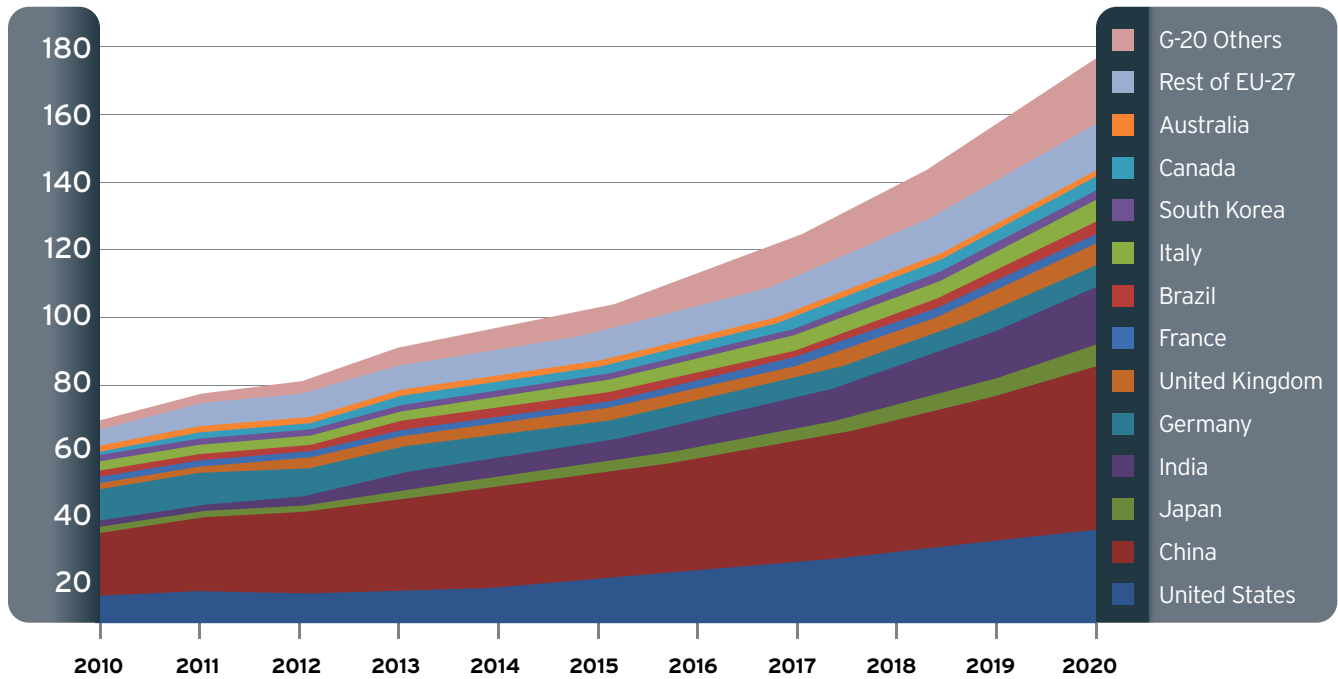
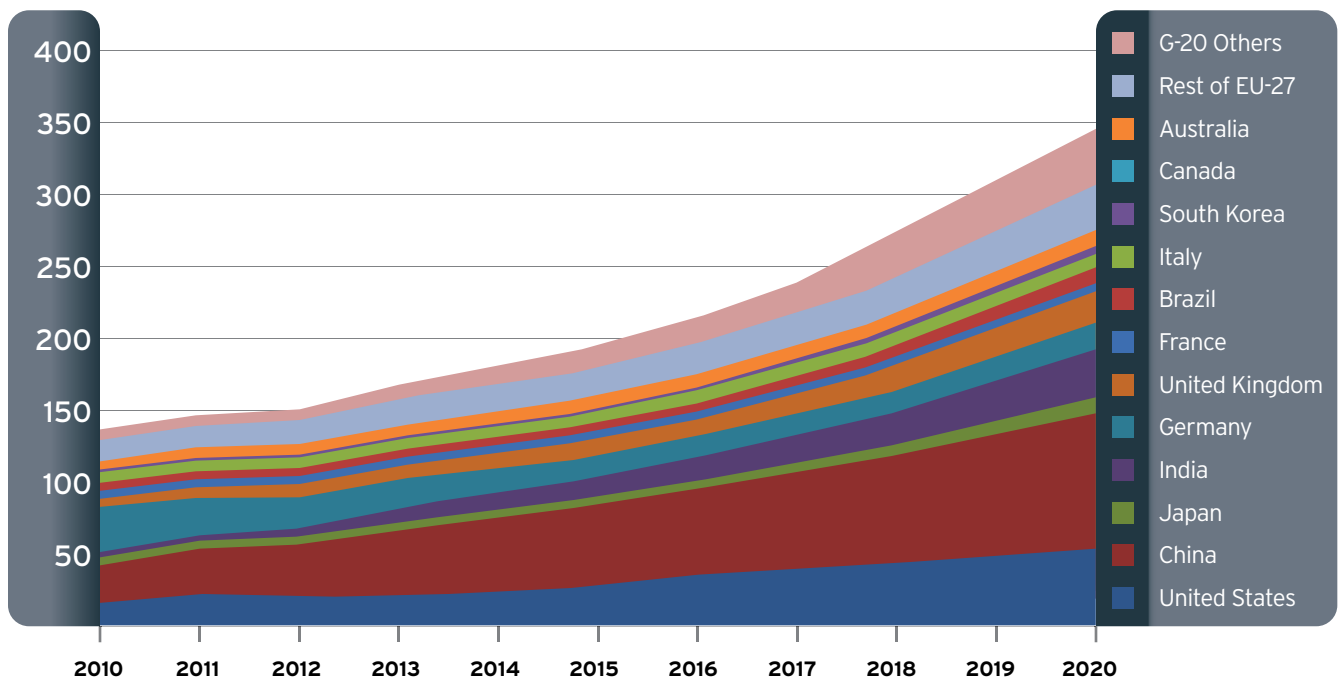


FIGURE 22. ENHANCED CLEAN ENERGY POLICIES: G-20 INVESTMENT IN RENEWABLE ENERGY ASSETS, (BILLIONS OF \$)



KEY FINDINGS

1. OPPORTUNITY ABOUND

All G-20 countries have an opportunity to attract more private investment in renewable energy assets by adopting strong clean energy policies. In turn, these investments will yield economic and environmental benefits in terms of increased jobs and reduced emissions of greenhouse gases. By 2020, enhanced clean energy policies could increase annual investments in G-20 renewable energy assets by more than \$200 billion over 2010 levels, a 161 percent increase. By contrast, current and Copenhagen policies increase investment levels by a much more modest 46 and 64 percent, respectively, above 2010 levels. Cumulatively, the enhanced clean energy policy scenario results in total investments in G-20 renewable energy assets of \$2.3 trillion - \$546 billion more than is projected under the current policy scenario.

The investment levels realized by individual members of the G-20 are not set in stone. With enhanced policies (e.g., strong renewable electricity standards, putting a price on carbon), countries can attract increased private investment in renewable energy projects. On average, enhanced clean

energy investments will increase cumulative investments across the G-20 by more than 30 percent. Increased investment levels in the G-20, individually and collectively, present opportunities for all nations. In today's global marketplace, producers and suppliers have worldwide export opportunities. Companies that create, produce and engineer clean energy goods and services have an opportunity to compete for business opportunities throughout the G-20.

2. ASIA LEADS IN CLEAN ENERGY INVESTMENTS BASED ON SURGING GROWTH IN CHINA AND INDIA

In 2010, Asia emerged as the top regional destination for clean energy finance and investment - a position that it is projected to maintain through 2020 thanks to rapid investment growth in the region. Within the G-20, China, India, Japan and South Korea are projected to account for approximately 40 percent of clean energy project investments in 2020 under all three scenarios, with the Americas and Europe trailing. Asia's growth is driven in large part by increased demand. It is expected that 90 percent of energy demand growth will come from developing countries

over the next 20 years. Of that incremental energy demand growth, 53 percent is expected to come from China and India alone.⁷

China leads the way in attracting clean energy investments. Under the enhanced clean energy scenario, China attracts \$93 billion in clean energy asset financing in 2020. Cumulatively, in this scenario, \$620 billion is projected to be invested in renewable energy assets in China over the next 10 years. India is the other rising clean energy leader in Asia. Although India ranked 10th in 2009 in private clean energy investments among G-20 members, it is expected to rise to third position under all three 2020 scenarios modeled in this report. Annual clean energy investment in India is forecast to grow by as much as 763 percent over the next decade under enhanced clean energy policies and 369 percent under current policies.

3. THE UNITED STATES WOULD BENEFIT FROM STRONG CLEAN ENERGY POLICIES

Renewable energy asset financing is projected to rise in the United States under all scenarios. But the United States would benefit from strong clean energy policies. If the United States enacted enhanced national

⁷ World Energy Outlook 2009 Fact Sheet, *Why is our current energy pathway unsustainable?* International Energy Agency, www.iea.org/weo/docs/weo2009/fact_sheets_WEO_2009.pdf.

clean energy policies, investment would ramp up to \$53 billion annually by 2020 – a rise of 237 percent over 2010 levels. Under current and Copenhagen policies, investment rises 73 and 90 percent, respectively. Cumulatively, over the next decade, the United States has the potential to attract \$342 billion in private clean energy investments. In fact, the United States is among the three countries with the most to gain from adoption of aggressive clean energy policies when enhanced policies are compared to current ones. The difference between cumulative investments in the current policies and enhanced clean energy policies scenarios for the United States is \$97 billion (40 percent). Only India and the United Kingdom, which could increase cumulative investments 48 percent under the enhanced policy scenario, have the potential to increase investments at a higher rate.

4. EUROPE'S CLEAN ENERGY ECONOMY MATURES

The EU has the potential to increase cumulative investments by 20 percent to \$705 billion from 2010 to 2020 if the enhanced policy scenario is realized. Given the early leadership of the European marketplace in clean energy development, it is expected that it will mature in the coming decade, as investment in some of the early leading nations declines and new entrants

step forward. Growth opportunities are greatest for Southern Europe and in offshore wind. Under all scenarios, in the next decade Europe falls behind Asia in renewable energy asset financing. Nonetheless, clean energy investments in Europe will remain sizable. Taken together, EU Member States are expected to attract \$56 billion in annual investments by 2020 under current policies, \$62 billion if Copenhagen pledges are met and \$85 billion if enhanced clean energy policies are pursued. In this scenario, investments in the United Kingdom increase by a robust 260 percent, but fall in Germany and grow by less than 50 percent in France and Italy. In terms of cumulative investments from 2010 to 2020, Germany has the potential to realize more than \$208 billion worth of investment in the enhanced policy scenario, followed by the United Kingdom at \$134 billion, and Italy at \$90 billion. Strong European growth in the enhanced policies scenario occurs in the other EU Member States, which collectively could see cumulative investments of \$216 billion over the 2010-20 timeframe.

5. CLEAN ENERGY POLICIES REDUCE GREENHOUSE GAS EMISSIONS

Under all scenarios, increased investment helps to stem greenhouse gas emissions by G-20 members, which account for the overwhelming majority of global emissions. That said, only the enhanced clean energy policy scenario is consistent

FIGURE 1. GLOBAL AVERAGE TEMPERATURES AND CORRELATING EXPECTED SEA-LEVEL RISE

Category	CO ₂ concentration at stabilization (2005 = 379 ppm)	CO ₂ equivalent concentration at stabilization including GHGs and aerosols (2005 = 375 ppm) ^b	Peaking year for CO ₂ emissions ^{a,c}	Change in global CO ₂ emissions in 2050 (percent of 2000 emissions)	Global average temperature increase above pre industrial at equilibrium, using “best estimate” climate sensitivity	Global average sea-level rise above pre industrial at equilibrium from thermal expansion only	Number of assessed scenarios
	ppm	ppm	year	percent	°C	meters	
I	350 – 400	445 – 490	2000 – 2015	-85 to -50	2.0 – 2.4	0.4 – 1.4	6
II	400 – 440	490 – 535	2000 – 2020	-60 to -30	2.4 – 2.8	0.5 – 1.7	18
III	440 – 485	535 – 590	2010 – 2030	-30 to +5	2.8 – 3.2	0.6 – 1.9	21
IV	485 – 570	590 – 710	2020 – 2060	+10 to +60	3.2 – 4.0	0.6 – 2.4	118
V	570 – 660	710 – 855	2050 – 2080	+25 to +85	4.0 – 4.9	0.8 – 2.9	9
VI	660 – 790	855 – 1130	2060 – 2090	+90 to +140	4.9 – 6.1	1.0 – 3.7	5

Source: *Climate Change 2007: Synthesis Report*, Intergovernmental Panel on Climate Change, www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr.pdf, p. 67.

with the absolute reductions in greenhouse gas emissions by 2020 that scientists suggest are necessary to avoid global warming in excess of 2 degrees Celsius. In the current policies scenario, global carbon emissions increase by 24 percent over 2005 levels. Our modeling also shows that pledges made by nations in conjunction with the UNFCCC COP in Copenhagen (See Appendix II) have only a modest environmental impact - with global carbon emissions increasing 21 percent over 2005 levels over the next decade, not enough to stabilize concentrations at the level identified by the Intergovernmental Panel on

Climate Change (IPCC) to avert far-reaching effects of climate change. But emissions in the enhanced policy scenario are just over 44 gigatons of carbon equivalent, the level that the United Nations Environment Programme recently estimated is consistent with the goal of keeping global warming below 2 degrees, as Figure 1. presents.

6. RENEWABLE ENERGY CAPACITY ADDITIONS COULD EXCEED 177 GW ANNUALLY BY 2020

All clean energy technologies will be deployed in increasing quantities

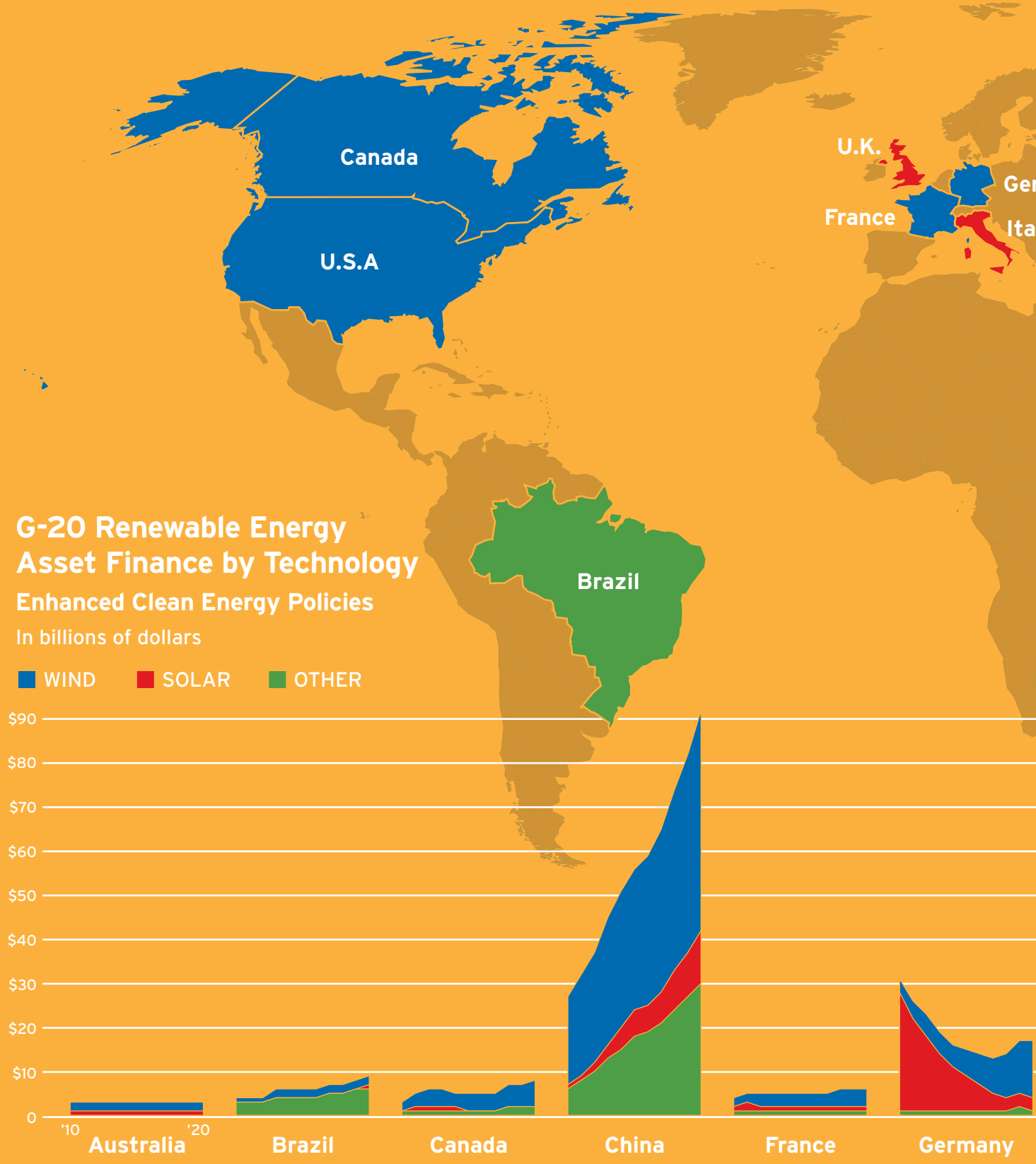
over the next 10 years. Under the enhanced clean energy policies scenario, annual renewable energy capacity additions could exceed 177 GW by 2020. Collectively, the G-20 could see cumulative capacity additions of 1,180 GW over the next decade if the enhanced policy scenario is realized.

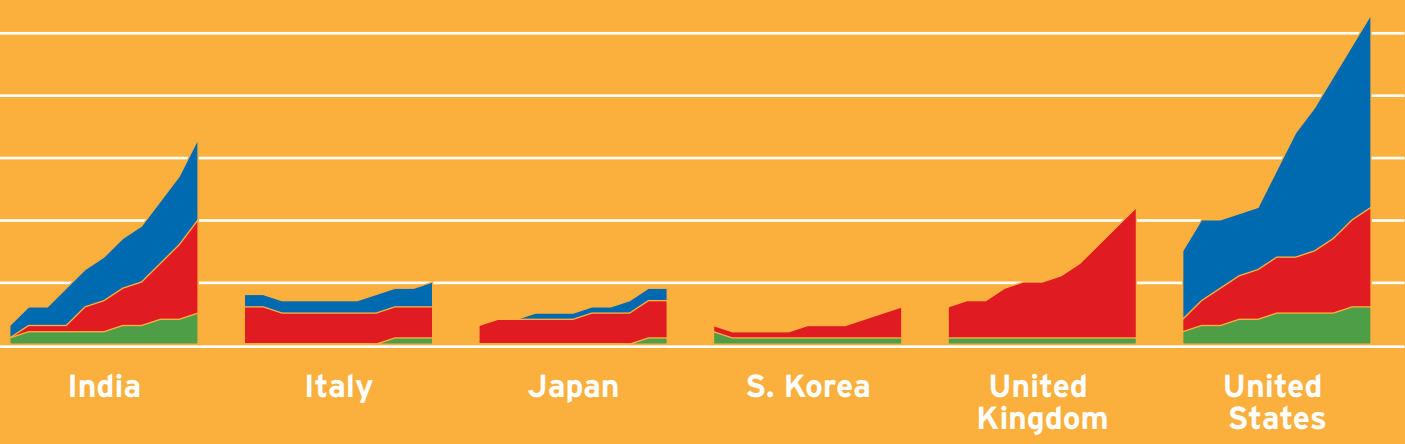
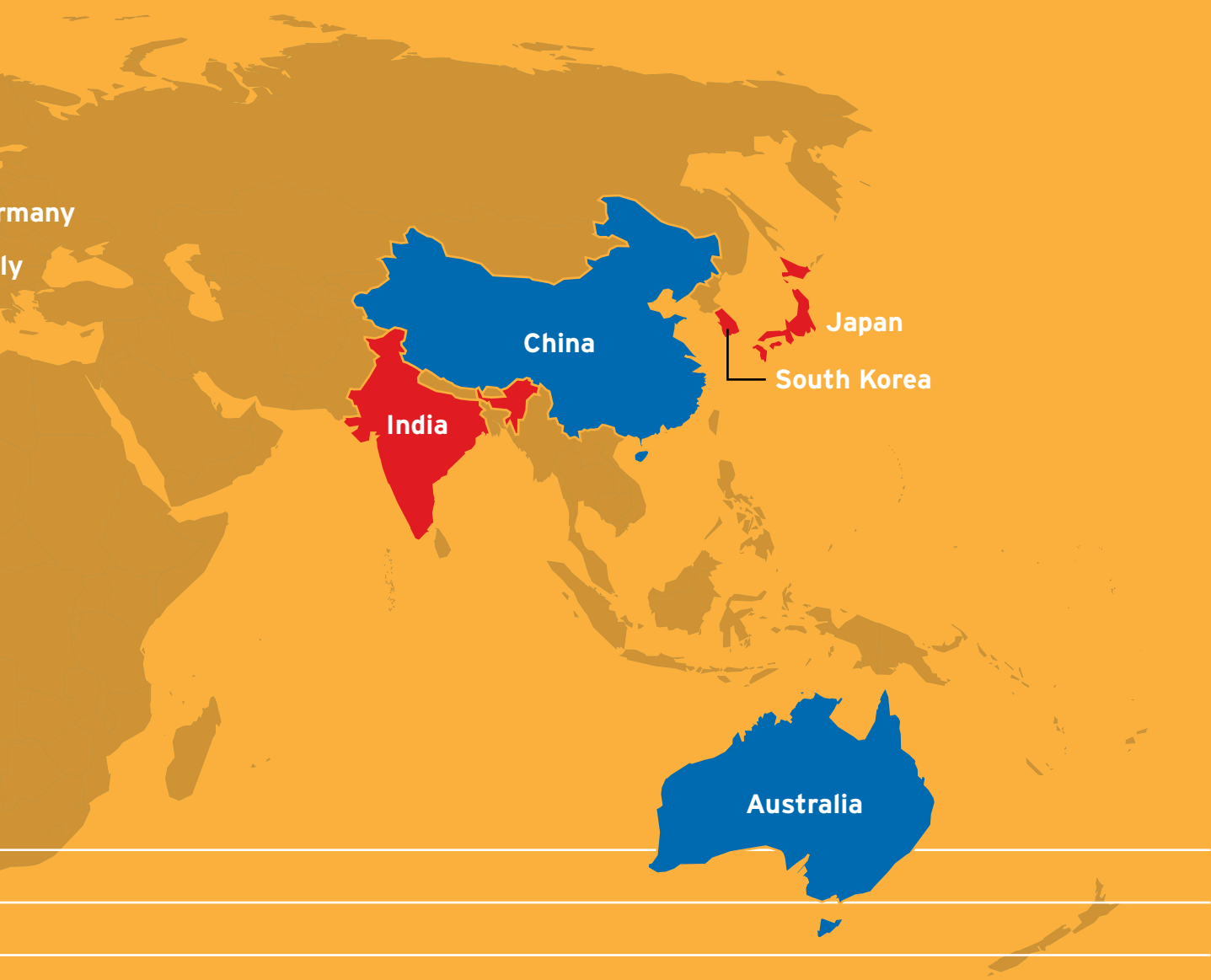
Figure 23 shows the technology that receives the most investment in each of the G-20 countries discussed individually in this report.⁸

⁸ See Country Profiles in Appendix IV

FIGURE 23

Primary Investment Technology by Country, 2020





WIND

Wind energy will continue to be the leading recipient of large-scale asset financing through 2020, reflecting its status as a relatively mature and cost-competitive, large-scale clean energy technology. Under current policies, asset financing in wind technologies rise to \$110 billion, an increase of 86 percent over 10 years. Under the Copenhagen policies scenario, wind energy investments in 2020 are estimated to be \$12 billion higher than under the current policies level. In contrast, under the enhanced clean energy scenario, asset financing in wind is projected to be \$190 billion – an increase of 222 percent over 10 years.

Many countries see wind as a clean, safe, price-competitive resource and therefore have placed it at the core of their renewable energy strategy, accounting for the wind sector’s considerable share of the total investment. In China, for example, bank lending and government measures have encouraged wind project financing including wind “mega bases.” Indeed, wind is projected to account for more than

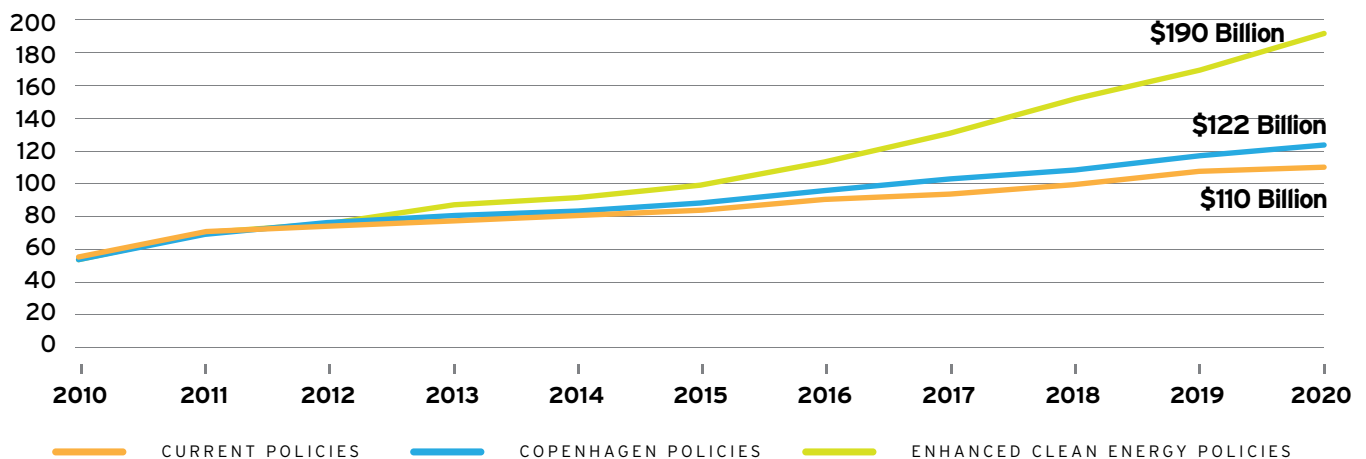
50 percent of renewable energy investment in China by 2020 under all scenarios. Of this, about two-thirds of the investment in wind power would be directed toward onshore projects, although offshore is likely to increase more rapidly over the next decade.

China is not alone in favoring wind; it accounts for more than 60 percent of investment in Germany, France, Canada, the United States and the United Kingdom.



© Stephen Meese | Shutterstock.com

FIGURE 24. WIND – ANNUAL INVESTMENT IN RENEWABLE ENERGY ASSETS, 2010-20 (BILLIONS OF \$)





© Elena Elisseeva | Shutterstock.com

SOLAR

The future for private investment in solar energy assets is bright, with solar attracting the second-greatest amount of investment among renewable energy technologies through 2020. These investments will help dramatically reduce the price of solar energy, making it more competitive with conventional and other solar energy technologies.

Bloomberg New Energy Finance’s expert analysis is that solar technology costs could fall by as much as 40 percent over 2010-20 due to experience curve effects. This occurs when costs decrease as a result of efficiencies gained through labor efficiency, network building, changes in the resource mix, standardization and/or method improvement.

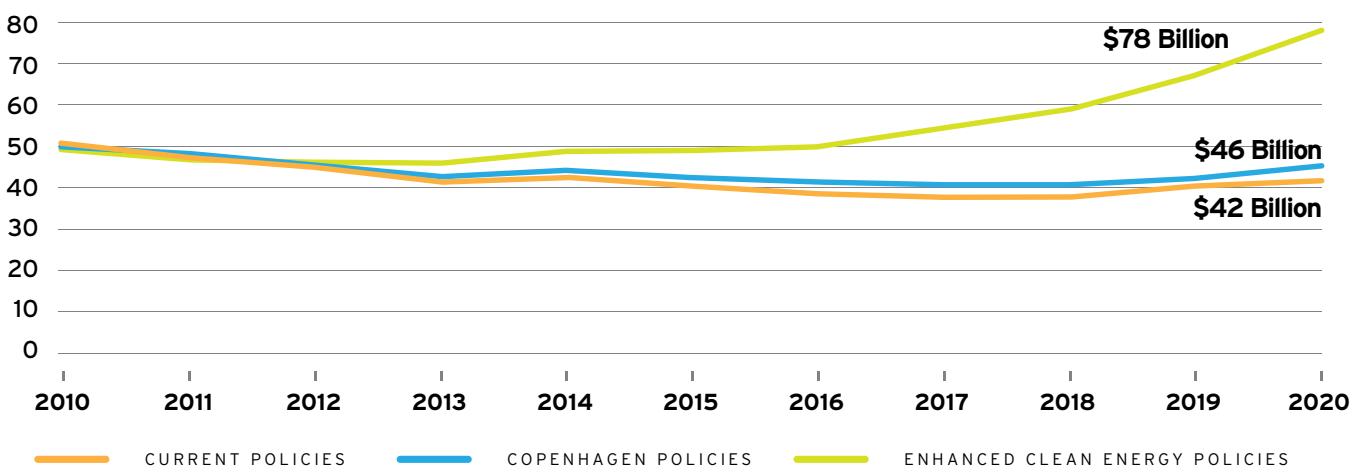
The experience curve effects help explain why total investments in solar energy could fall 10 to 18 percent over the next decade under current and Copenhagen policies. Simply put, price reductions will outpace capacity additions such that overall investments will fall, even as sales increase

and capacity is added. If countries adopt ambitious policies— as under the enhanced clean energy scenario—renewable energy capacity could increase enough that asset financing in solar climbs by 53 percent.

The potential fall in solar energy investments under certain scenarios is also linked to the anticipated steady decline in solar asset financing in Germany. In addition to experience curve effects, today’s high levels of solar power growth in Germany are unsustainable in the long term because electricity demand is likely to level off. So even if the number of solar installations in Germany remains stable year to year, investment will fall as capital expenditure per watt of electricity decreases.

Still, the solar sector accounts for the largest share (after wind) of asset financing in G-20 countries and maintains this position under all scenarios, retaining a fairly constant share of total investment. Indeed, despite wind’s prominent position in numerous countries’ renewable strategies, solar accounts for more than 30 percent of total investment in several countries, including Australia, Italy, Japan and India.

FIGURE 25. SOLAR – ANNUAL INVESTMENT IN RENEWABLE ENERGY ASSETS (BILLIONS OF \$)

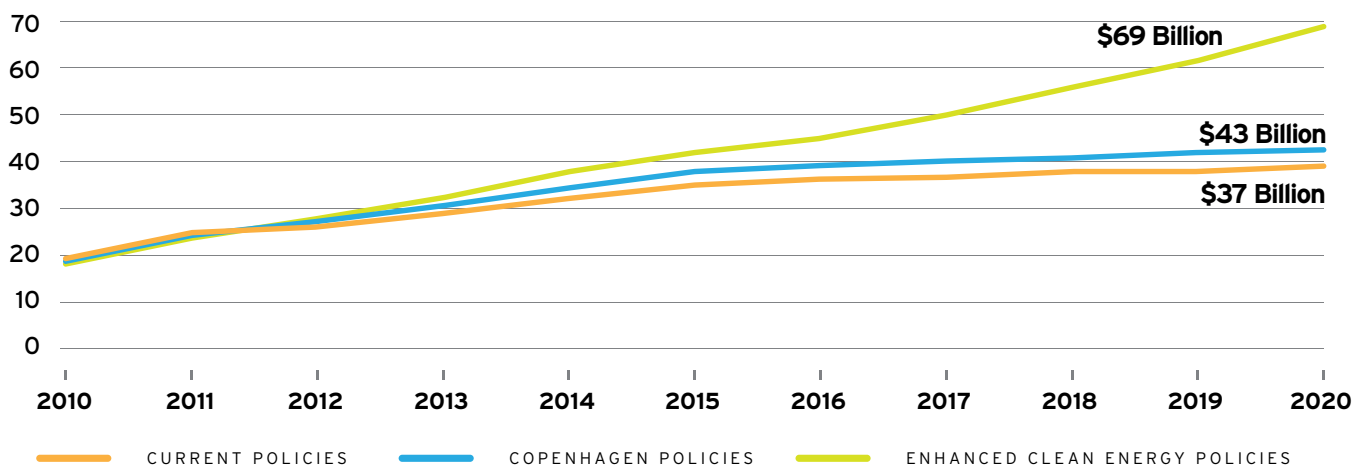


OTHER RENEWABLE ENERGY TECHNOLOGIES

The good news for biomass, geothermal, waste energy and small-hydro power is that, collectively, investment levels in this category rises more than in wind and solar if countries opt to implement more ambitious

clean energy policies. Financing for these other clean energy technologies climbs by a considerable 263 percent to \$69 billion in 2020 under the enhanced clean energy policy scenario, compared with an increase of 222 percent increase for wind and 52 percent for solar. Even if no further policies are enacted, investment in other technologies still grows by 95 percent.

FIGURE 26. OTHER RENEWABLE ENERGY TECHNOLOGIES (BILLIONS OF \$)



Note: Other renewable technologies refers to biomass and energy from waste, small hydro, geothermal and marine technologies.

Of these technologies, biomass and energy from waste, along with small-hydro, receive the most financing, while comparatively little is spent on geothermal and marine technologies. In Canada and China, for example, small-hydro is the third-leading technology after wind and solar. Investment in biomass and energy from waste is less than that for wind and solar in France, Italy,

Japan and the United States, but it receives only a small share of financing. India and Brazil's investments in biomass and energy from waste take second place, ahead of solar. India supports financing of these technologies through feed-in tariffs, while Brazil's government is actively promoting biomass as a primary alternative to its current reliance on small-hydro.

7. POLICY MATTERS

The extraordinary worldwide growth in clean energy investment over the past five years has been defined by a simple fact: Where supportive clean energy policies are adopted, investment follows. Time and again, it has been shown that nations with the strongest policy frameworks have attracted the most capital and enjoyed the associated economic benefits, including job creation. In today's integrated global economy, no country or company can develop a monopoly on clean energy production. Growth in the clean energy sector creates jobs up and down the supply chain - from engineering to shipping - and market expansion can benefit workers and businesses around the world.

If G-20 members do not implement any further policies, investment in renewable energy assets is projected to reach \$189 billion by 2020—a modest 46 percent above 2010 levels. If those nations implement their pledges made in Copenhagen, financing grows incrementally to \$212 billion—growth of 64 percent over 2010. However, if comprehensive and effective measures are introduced to maximize the nation's share of the global clean energy economy, investment could reach \$337 billion annually in 2020—an increase of 160 percent compared with 2010 investments in renewable energy assets.

These impressive investment levels reveal the enormous potential for nations to benefit from renewable energy investment growth over the next decade if countries adopt enhanced energy and climate policies. It is clear from the research that neither current policies nor the emission reduction targets pledged by member nations under the Copenhagen Accord in January 2010 are sufficient to maximize renewable energy investment or to meet worldwide goals for curbing global warming

THE ROOTS OF GERMANY'S SOLAR ENERGY MANUFACTURING LEADERSHIP

Germany is the world's largest solar energy technology market, accounting for as much as 50 percent of new solar installations annually. In the first six months of 2010 alone, Germany added 3GW of new solar generating capacity.¹ Not surprisingly, Germany is also home to a robust solar manufacturing sector, which has accounted for more than 40 percent of the global market in recent years², but now faces pressure from China's ambitious clean energy efforts.

The German solar success story is a direct result of its early adoption of ambitious clean energy policies. In the late 1990s, Germany embarked on its "100,000" solar roofs plan, followed by adoption of one of the world's first renewable electricity standards and accompanying feed-in tariffs. The resulting growth in demand was supported by robust research and development expenditures. Together, these forces helped spur domestic manufacturing, which in turn helped to develop a domestic supply chain that further enhanced the production capabilities and efficiencies. As a result, Germany has been able to create 10,000 jobs in the solar manufacturing and installation sector³.

¹ [en.solarwirtschaft.de/home/news/meldung/article/photovoltaic-market-is-booming-in-the-first-half-of-2010.html?tx_ttnews\[backPid\]=1041&cHash=ccb7bd6c7e](http://en.solarwirtschaft.de/home/news/meldung/article/photovoltaic-market-is-booming-in-the-first-half-of-2010.html?tx_ttnews[backPid]=1041&cHash=ccb7bd6c7e)

² thebreakthrough.org/blog/case_studies_in_american_innov

³ Ibid

PRICING CARBON EMISSIONS

The EU has been a leader in mandating that emitters of harmful greenhouse gases pay a price for carbon emissions to account for their impact on the planet. But there is growing evidence that a carbon policy alone is insufficient to trigger significant renewable energy investment. A relatively soft emissions reduction target may incentivize power companies to use somewhat less coal, but not necessarily to add more clean energy capacity. Given current low natural gas prices, the simplest strategy for many generators is simply to switch from coal to gas. However, with a higher carbon price and stronger emission targets, new building in the power sector must become carbon-neutral, thereby incentivizing less costly, low-carbon technologies such as wind and nuclear power. Some renewables policies would still be needed to promote the higher-cost renewables, such as solar and other technologies like carbon capture and storage that can help reduce greenhouse gas emissions.

RENEWABLE ELECTRICITY TARGETS/STANDARDS

Nations around the globe, including India and the EU, have set national goals under which utilities are to provide certain amounts of clean power generation. The United States has no national goal, but some 30 states have set binding clean energy targets. Under virtually all of these

targets, utilities are compelled to buy certain numbers of megawatt-hours from clean energy sources to comply with the overall requirement. In a number of cases, utilities can buy renewable electricity credits or pay penalties to comply instead.

CLEAN ENERGY TAX INCENTIVES

A number of governments around the globe, including the United States and India, use the tax code to ease costs associated either with manufacturing clean energy equipment or building a new clean power generating project. This can take the form of accelerated depreciation under which companies can quickly write off the cost of an investment. Or it can be a tax credit system allowing companies to subtract directly from their annual tax bill some portion of the cost of building a new manufacturing plant or power generating project.

FEED-IN TARIFFS

Feed-in tariffs (FITs) reward owners of renewable energy projects with a premium for producing clean power. FITs offer developers higher (often much higher) prices for every megawatt-hour of clean power produced and aim to create a proxy market for new clean energy technologies that roughly reflects the value of avoided externalities and/or reflects other public policy imperatives (improving energy security, increasing targeted industrial development, etc.). Properly designed FITs



help assure entrepreneurs who invest in the successful generation of power from renewable resources that they can earn an acceptable return, because they can provide both enhanced prices with guaranteed purchases and advantageous grid access.

GOVERNMENT PROCUREMENT

Due to their size, governments have substantial market power and can place orders large enough to allow the clean energy sector to ramp up production and enjoy economies of scale on the cost side. With the









current over-supply of clean energy technology, governments can help empty warehouses, support margins and spur further manufacturing. Examples of government procurement efforts include the United States military's commitment to increasing its reliance on clean power to address both climate and energy security concerns.

REVERSE AUCTIONS / POWER TENDERS

In countries where the state plays the dominant role in managing the electricity grid, reverse auctions or

power tenders have been used to encourage development of renewable energy projects. Such programs typically involve the grid operator announcing a goal of procuring a certain amount of clean energy generation within a certain number of years. Developers then "bid in" by promising to build projects that generate power at certain prices. Developers deemed credible that offer to sell their power for the lowest price "win" the reverse auction and are offered long-term power sales contracts. The developer can then build the project to fulfill the contract's obligation.

PARTY	TARGET AS STATED TO THE UNFCCC
 ARGENTINA	No Copenhagen pledge received.
 AUSTRALIA	Australia will reduce its greenhouse gas emissions by 25 percent of 2000 levels by 2020 if the world agrees to an ambitious global deal capable of stabilizing levels of greenhouse gases in the atmosphere at 450 ppm carbon dioxide equivalent (CO ₂ -eq) or lower. Australia will unconditionally reduce emissions by 5 percent below 2000 levels by 2020, and by up to 15 percent by 2020 if there is a global agreement that falls short of securing atmospheric stabilization at 450 ppm CO ₂ -eq and under which major developing economies commit to substantially restrain emissions and advanced economies take on commitments comparable to Australia's.
 BRAZIL	Expected reduction from business as usual (BAU) emissions in 2020 by 36.1 to 38.9 percent.
 CANADA	Reduction of 17 percent from 2005 levels by 2020, to be aligned with the final economy-wide emissions target of the United States in enacted legislation.
 CHINA	Reduction in carbon intensity of 40 to 45 percent by 2020 compared with 2005 levels.
 EUROPEAN UNION	As part of a global and comprehensive agreement for the period beyond 2012, the EU conditionally offers to move to a 30 percent reduction by 2020 compared to 1990 levels, provided that other developed countries commit to comparable emission reductions and that developing countries contribute adequately according to their responsibilities and respective capabilities.
 INDIA	Reduction in carbon intensity by 20 to 25 percent by 2020 compared with 2005 levels.
 INDONESIA	Reduction of 26 percent by 2020, no baseline specified.

PARTY	TARGET AS STATED TO THE UNFCCC
 JAPAN	25 percent reduction, which is premised on the establishment of a fair and effective international framework in which all major economies participate and on agreement by those economies on ambitious targets.
 MEXICO	30 percent below BAU by 2020.
 SOUTH KOREA	30 percent below BAU by 2020.
 RUSSIA	Reduction of 15 to 25 percent below 1990 levels. The range of the greenhouse gas emissions reductions will depend on the following conditions: appropriate accounting of the potential of Russia's forestry in frame of contribution in meeting the obligations of the anthropogenic emissions reduction, undertaking by all major emitters the legally binding obligations to reduce anthropogenic greenhouse gas emissions.
 SAUDI ARABIA	No Copenhagen pledge received.
 SOUTH AFRICA	34 percent below BAU in 2020.
 TURKEY	No Copenhagen pledge received.
 UNITED STATES	In the range of 17 percent below 2005 levels by 2020, in conformity with anticipated United States energy and climate legislation, recognizing that the final target will be reported to the Secretariat in light of enacted legislation.

Each year since its inception as an independent firm in 2004, Bloomberg New Energy Finance has tracked all forms of investment in the clean energy sector by counting private and public financings, then making logical assumptions about those financings it cannot account for. Bloomberg New Energy Finance subdivides private capital into primarily three key categories: asset finance (the funding of new clean energy projects), venture capital and private equity (VC/PE) investments, and funds raised via the public markets. Of these three, asset finance typically accounts for just over 60 percent of all dollars invested worldwide. By comparison, VC/PE and public markets account for relatively small slices of overall investment.

This report projects G-20 asset financing for renewable technologies used to generate electricity through 2020 – including wind, solar (photovoltaic and solar thermal electricity generation), biomass and energy from waste, small-hydro, geothermal and marine technologies.⁹ For reference purposes, asset finance investments in 2009 totaled \$107 billion globally, of which the G-20 accounted for \$95 billion.

Future forecasts are derived from the Bloomberg New Energy Finance Global Energy & Emissions Model (GE²M), an integrated fundamentals model covering

all energy and emissions-intensive sectors around the world with consideration over time for dynamic economic, policy and behavioral factors.

For this report, GE²M has been put to use for one purpose: to project levels of deployment of renewable power generation in the future and to determine how many private sector dollars will be invested to make that so. Looking at the three policy scenarios described below, GE²M was run to forecast new megawatts that would be added each year. Dollar estimates were then generated by multiplying total number of megawatts expected online in various scenarios by the projected dollar-per-megawatt costs of each of the key clean energy technologies. These costs were plotted into the future by Bloomberg New Energy Finance analysts based on their study and understanding of clean energy gleaned over five years of research.

This report examines asset financing only because that is what can be reliably forecast in GE²M. Projecting VC/PE, public market and other forms of financing falls outside the model's bounds as it is currently designed.

Given that asset finance has accounted for about 60 percent of overall investment each year in the past, Bloomberg New Energy Finance could simply have assumed that

⁹ This report excludes investments in carbon capture and storage, energy efficiency, biofuels and grid investment.

would continue to be the case going forward and multiplied the GE²M outputs for asset finance by 1.66 to reach a total estimated investment figure. Such a methodology would over-simplify matters, however. Much of the non-asset finance funding that went into clean energy in the past five years is due strictly to the fact that the industry is technologically relatively immature. The funds that have been deployed to support new technologies via VC/PE investments or corporate research and development budgets should theoretically begin to taper off as these technologies mature. Similarly, public markets funding often goes toward supporting the expansion of manufacturing capacity for solar modules, wind turbines, or other equipment. But once enough assembly lines have been built to meet all market demand, those new funds too will no longer be necessary. Finally, government financing should also begin to diminish as the cost of clean energy technology deployment falls and wind, solar, geothermal, biomass, marine, small-hydro, and other renewable projects can compete head-on with fossils without the benefit of subsidies.

In short, once clean energy technologies mature, asset finance should represent a much larger percentage of overall clean energy investment than the 60 percent it does today, perhaps reaching as high as 90 percent of all new funds in a given year, or more. However, calculating the rate at which the scale-back of non-asset finance takes place is not built into GE²M. Thus the focus here is strictly on asset finance over the next decade.

Finally, the GE²M projections for this study focus solely on the financing of renewable electricity generation projects, which are nearly completely emissions-free. It does not take into account potential investments in biofuels, which are not modeled into GE²M. At this point, predicting investment in biofuels is particularly problematic given the very aggressive Renewable Fuels Standard (RFS) on the books in the United States. That standard would see the United States blend 36 billion gallons of biofuels into the nation's fuel supply by 2022, up from 12 billion gallons today. That 24 billion gallon addition would represent an approximate 65 percent jump over

current global capacity for biofuels. The policy also assumed a steep increase in capacity from cellulosic ethanol, which has yet to happen. Meanwhile, about a third of the United States corn supply will go toward ethanol in 2010. Both suggest that policymakers could determine that the 36 billion gallon standard is not practical and scrap it at some point. Investment in biofuels globally would be dramatically affected by the disappearance of the RFS, and this report makes no effort to predict the policy's future existence.

This report also does not seek to take into account investments in energy efficiency improvements, which will inevitably grow under all three scenarios. Although improving the efficiency of everything from conventional power plants to automobiles to residences will play a critical role in addressing the climate challenge, they are not quantified in GE²M. Businesses invest constantly in improving the efficiency of their operations, but divining how much such investments are motivated by policy as opposed to merely seeking to improve profitability is not a question this study seeks to answer.



ARGENTINA

Argentina's clean energy sector has been slow to mature. Despite some exceptional resources, the country saw just \$80 million invested in the sector in 2009 and has roughly 1 GW in cumulative installed renewable capacity as of late 2010. Clean energy could help meet energy demands in Argentina, which faces a critical shortfall in energy supply, due to increasing restrictions on gas imports from Bolivia. The country has underinvested in generation capacity since 2001, primarily because of a lack of available capital.

Comparatively weak subsidies supporting renewable energy are at least partly to blame for Argentina's slow progress. The federal government offers minimal production tax credits for most renewable energy generation sectors, except for solar, and has adopted few other supportive laws or incentives. Instead, federal policy has been aimed more at fostering Argentina's biofuels industry. Today, the country has 2 billion liters in annual biodiesel production capacity, though the sector falls under careful government control.

A surge in new renewable energy capacity seems unlikely, at least in the near future. While the country has a stated national goal of sourcing 8 percent of its power from renewables by 2016 (roughly equivalent to 2 GW capacity), the target is nonbinding. The government plans to hold tenders and offer a feed-in tariff program aimed

at small-scale development, but those policies will likely be insufficient to spur enough development to meet the overall goal.

Argentina is among the several G-20 members that did not submit an emission reduction commitment to the U.N. following the Copenhagen climate summit. Instead, the country sent a letter outlining its various clean energy and energy efficiency measures and indicating that it would consider emission reduction goals once the developed nations have set binding targets for themselves.

If Argentina is interested in having renewable technologies play a major role in the country's energy future, policymakers could consider a more binding clean energy standard to ensure developers and financiers alike that a market exists for their power. However, policymakers also need to address the lack of available capital for renewable energy as well. Although other nations assist clean energy development banks and other financing authorities, Argentina has to date made no such resources available. The government could also consider making good on its indication that it might adopt a carbon reduction target if developed countries adopt binding emission reduction targets. Finally, Argentina's government could loosen its control over soy and exports at large to ensure the ongoing viability of the biodiesel sector.

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)

KEY INVESTMENT INCENTIVES	
Wind, Solar, Biomass, Small-Hydro	Production Tax Credits (PTC)

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	✓

*Includes investments in venture capital and public markets, and asset finance for all clean energy technologies including biofuels and energy efficiency.



AUSTRALIA

Australia is poised for important growth in the clean energy sector. By adopting enhanced clean energy policies, the country could increase clean energy investments by 325 percent to just over \$4 billion in 2020. Wind energy investments in all scenarios are expected to grow significantly over 2010 levels. In the enhanced policy scenario, the cumulative investment potential in Australia from 2010 to 2020 is projected as \$35 billion, which would leverage installation of 19 GW of renewable energy generating capacity.

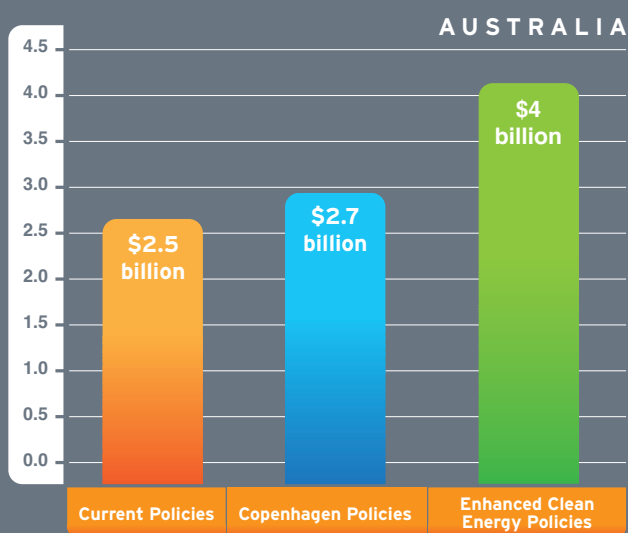
The government of Australia has adopted a mandate to source 20 percent of its electricity from renewables by 2020. It has begun to climb toward that target with 1.9 GW of wind installed by the end of 2009 and plans for more. The country has also set aside \$1.5 billion for a 1 GW solar program and has committed roughly \$2.5 billion for various carbon capture programs. The majority of Australia's states also offer small-scale solar feed-in tariffs but nothing is yet available at the federal level.

The country's renewable electricity standard (RES) is the key driver for renewable energy development but the government has been unable to agree on complementary national programs needed to further provide incentives for development. The government has delayed until the end of 2011 consideration of options

for putting a price on carbon, which would help make renewables more attractive. The country committed to reducing emissions by at least 5 percent below 2000 levels by 2020 in its Copenhagen pledge and said it would commit to as much as 25 percent below 2000 levels if other nations adopted aggressive targets. Australia is also considering an extension of a biofuels tax incentive program slated to expire in July 2011.

Given the country's hopes for wind, solar and carbon capture and sequestration (CCS) in its energy future, more dramatic steps may be considered. Besides putting a price on carbon, Australia could place a moratorium on conventional coal plants and relax subsidies for fossil fuel energy production to further fund its CCS programs. Meanwhile, the government might establish a national small-scale solar feed-in tariff program based on the existing state programs, and undertake transmission and smart grid programs to better integrate distributed energy across its large landmass. To further boost its wind and solar sectors, the government could direct funds toward venture capital programs to foster technology development. Finally, the biofuels tax credit will lead to significant new development only if it is paired with more a stringent renewable fuels standard.

FIGURE 27. INVESTMENT IN RENEWABLE ENERGY ASSETS, 2020 (BILLIONS OF \$)



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%
Key Renewable Energy Sectors	
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

*Includes investments in venture capital and public markets, and asset finance for all clean energy technologies including biofuels and energy efficiency.



BRAZIL

In Brazil, asset financing of renewables in 2020 would more than double to \$8.4 billion under the enhanced policy scenarios. Absent additional policy measures, private investment in renewable energy in Brazil is expected to remain stable at just under \$4 billion over the next 10 years. With strong energy policies, Brazil is poised for significant growth in wind energy investment and has one of the world's highest biomass and small-hydro power capacities, with more expected to be built over the next 10 years. In the enhanced policy scenario, the cumulative investment potential in Brazil from 2010 to 2020 is projected as \$67 billion, which would leverage installation of 25 GW of renewable energy generating capacity.

Already, Brazil has one of the lowest carbon electricity matrices in the world with nearly three quarters of the country's 2009 total installed capacity of 107 GW represented by hydro sources large and small. Non-hydro renewables accounted for 7 percent of capacity.

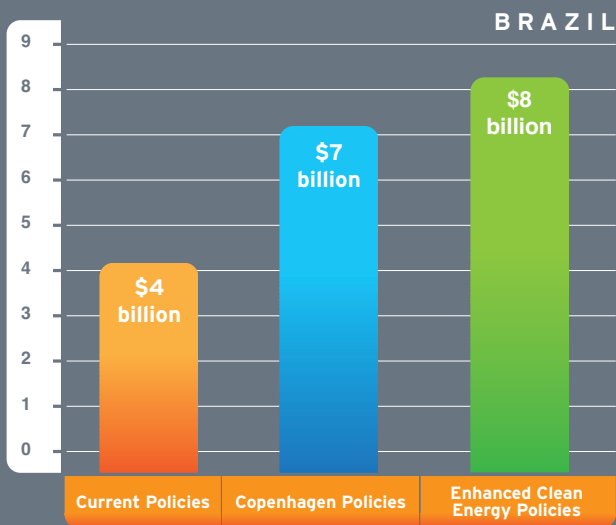
Brazil is the second-largest national biofuel market in installed capacity and number one in readily available resources for further capacity expansion. The country has actively supported development of these resources, including a mandatory 25 percent ethanol blend in gasoline and a 5 percent biodiesel mandatory blend. Brazil has removed most of its early incentives for ethanol because the sector can now compete directly with fossil fuels. Meanwhile, Brazil's financing programs, development bank loans and renewable energy auctions have led to healthy biomass and small-hydro power sectors, with 5.1 GW and 4.1 GW installed, respectively. Investors have

flocked to the country in recent years, giving Brazil a 148 percent five-year investment growth rate (including biofuels), second only to Turkey's.

The government's renewable energy auctions have been popular though plagued by problems, such as projects' difficulties in accessing transmission lines at a low cost. The government is considering a program in which the power contract auctions would be held annually, a move that would greatly improve the long-term certainty in Brazil's market. The country is also discussing a possible 10 percent renewable energy mandate by 2018, additional tax incentives for wind, solar, marine energy and electric vehicles, and exemptions for wind development from transmission tariffs. Finally, Brazil has offered to cut its 2020 business-as-usual emissions by at least 36 percent in its post-Copenhagen pledge. This would be done mostly through reduction in deforestation, but also through increased use of biofuels, energy efficiency programs and renewable energy, though it stressed that its targets were not binding.

Brazil could have more success if it adopted a federal renewable electricity standard and set consistent and yearly renewable energy power auctions. The government could also lower taxes on renewable energy and infrastructure projects. Taxes account for as much as 40 percent of projects' costs. In addition, the government could consider lowering interest rates through the central bank for project construction debt so that the national development bank BNDES is not the only institution offering attractive loans. Brazil would also do well to establish a cap-and-trade program in line with international programs.

FIGURE 28. INVESTMENT IN RENEWABLE ENERGY ASSETS, 2020 (BILLIONS OF \$)



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	
Biomass	5,100 MW
Small-Hydro	4,100 MW

KEY CLEAN ENERGY TARGETS (2012)	
Wind	1422 MW

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

*Includes investments in venture capital and public markets, and asset finance for all clean energy technologies including biofuels and energy efficiency.



CANADA

Under the enhanced policies scenario, \$8 billion is invested in renewable assets in Canada by 2020, a 175 percent increase over 2010 levels. The country is becoming a growing force in the North American wind market, and the industry is largely supported through feed-in tariffs and generous power-purchasing agreements offered by regulated provincial utilities. As such, wind accounts for two-thirds of the forecast 2020 investments in all scenarios. In the enhanced policy scenario, the cumulative investment potential in Canada from 2010 to 2020 is projected as \$63 billion, which would leverage installation of 32 GW of renewable energy generating capacity.

In Canada, the provinces determine their respective energy mixes, making it difficult to form a cohesive national market. However, the federal government has in recent years offered production-based incentives and beneficial tax and accounting rules for renewables. Those incentives are set to expire soon and the government has not indicated that it plans to extend them.

The federal government regulates emissions for Canada but has been similarly unaggressive in those policies, recently scrapping its climate change plan in favor of whatever the United States eventually adopts. For its Copenhagen pledge, Canada lowered its emissions reduction goal to match that of the Obama administration: 17 percent below 2005 levels by 2020.

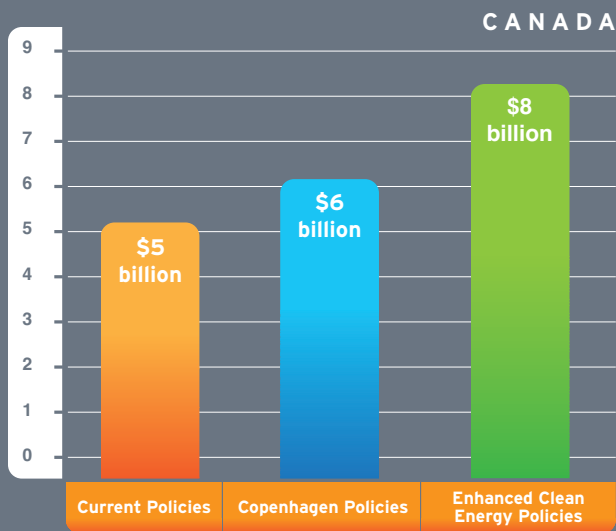
Meanwhile, some Canadian provinces have moved aggressively to promote renewables and reduce emissions. Ontario recently launched its

generous feed-in tariff program for renewable energy and has already signed more than 2.6 GW in contracts. Quebec plans to have 14 GW of renewable energy by 2035 with the rest of its mix coming mostly from large-hydro. British Columbia has signed a series of contracts that would put it well on its way toward reaching a goal to install 5 GW of new renewables in the next few years.

In terms of sheer natural resources, Canada has the potential to add extraordinary amounts of small-hydro, wind and marine capacity. The country also stands to export cleanly generated power to electricity-hungry United States markets. Canada could also benefit if the United States adopts stronger national policies mandating specific high levels of clean energy generation.

Still, the Canadian federal government can do its part. Canada could extend its current renewable energy incentives and adopt a national cap-and-trade program in line with those already proposed at the provincial level in Ontario, Quebec, Manitoba and British Columbia. A national policy would also make renewables more attractive in Alberta, where emissions are slated to continue rising until at least 2020. To force growth of Alberta's renewable energy market, Canada could also impose a moratorium on new coal and natural gas development that does not include at least 90 percent carbon capture. Commercial-scale power storage incentives and significant investments in east-west transmission to carry clean power between provinces would also ease renewables adoption.

FIGURE 29. INVESTMENT IN RENEWABLE ENERGY ASSETS, 2020 (BILLIONS OF \$)



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) ¹	
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 ²	
Wind, Solar, Biomass	Generation-based subsidies/Preferential loans

¹ Includes investments in venture capital and public markets, and asset finance for all clean energy technologies including biofuels and energy efficiency.

² Incentives primarily through provincial governments



CHINA

China leads the world in clean energy finance and investment and will continue to do so for the foreseeable future. China attracts more private investment in renewable energy assets under all scenarios, including a strong \$93 billion in 2020 under the enhanced policy scenario, a 246 percent increase over 2010 levels. Under current policies, clean energy asset financing in China grows by 87 percent to \$50 billion in 2020. Wind accounts for more than 50 percent of China's investments in all scenarios. In the enhanced policy scenario, the cumulative investment potential in China from 2010 to 2020 is projected as \$620 billion, which would leverage installation of 375 GW of renewable energy generating capacity.

These numbers are part of China's drive to meet its rising domestic demand for energy by installing extensive new capacity. Indeed, in 2009 China built new coal-fired power plants with a total capacity greater than all the power plants in New York State. It also added a world-record 37 GW of renewable energy in 2009 and now surpasses all countries in the world in installed renewable generating capacity.

To drive clean energy investments, China has set stringent renewable energy targets. In addition, the country has a successful feed-in tariff for wind and a "Golden Sun" solar subsidy program, both of which have helped China establish a domestic market for its strong manufacturing base. Topping off its strong clean energy framework is China's rapidly growing energy demand and an abundance of bank loans available for developers.

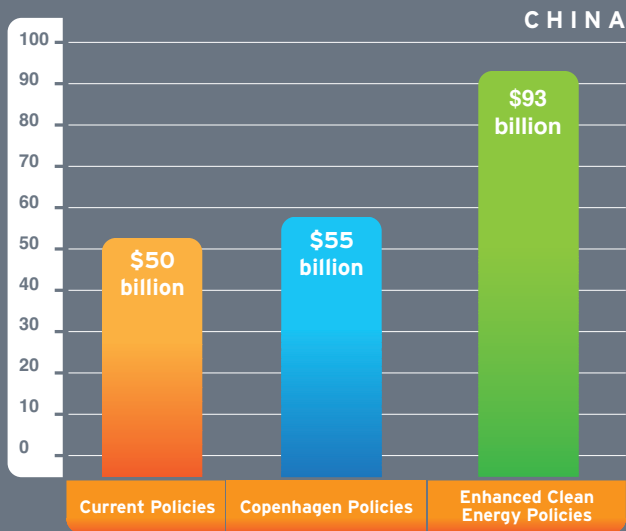
More help is on the way for the renewable energy sector in China. A feed-in tariff for solar energy

is being considered, along with 2020 renewables targets, which will very likely be revised upwards for most sectors. It will begin to provide much needed demand certainty for prospective investors and developers. The government has also begun to offer electric vehicle subsidies for individual buyers in five cities as a trial scheme. The few limitations on China's renewables sector are, however, substantial. Concerns about overcapacity, grid connection and market openness linger, keeping many from entering the market.

China must address these concerns with clear legislation and government infrastructure. The country is considering a pilot domestic cap-and-trade program that could be meshed with those of other countries. Ahead of the climate summit in Copenhagen, China committed to reducing its emission intensity – CO₂ emitted per unit of GDP – by 40-45 percent below 2005 levels by 2020. The country also needs a renewable portfolio standard paired with tradable renewable credits, which would provide openness and demand certainty in the market. China should also create an independent Ministry of Energy and further its work on energy price reforms. Finally, China can consider establishing national or provincial energy services companies. These energy conservation and risk management businesses can dramatically improve the economics of energy efficiency projects but have had difficulties securing financing in this highly fragmented market. National and/or provincial energy service companies (ESCOs)¹⁰ could go a long way toward demonstrating the market opportunities for investors and businesses alike.

¹⁰ An energy service company is a business that develops, installs and arranges financing for projects designed to improve the energy efficiency and maintenance costs for facilities over seven to twenty years. ESCOs generally act as project developers for a wide range of tasks and assume the technical and performance risk associated with the projects.

FIGURE 30. INVESTMENT IN RENEWABLE ENERGY ASSETS, 2020 (BILLIONS OF \$)



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

*Includes investments in venture capital and public markets, and asset finance for all clean energy technologies including biofuels and energy efficiency.



FRANCE

With nuclear energy as its primary source of electricity, France has more limited room to grow its renewable energy sector. As a result, even under the enhanced policy scenario, private investment in clean energy in France is projected to rise a modest 50 percent. Under current and Copenhagen policies, clean energy investment in France is projected to remain stable over the decade. Any nuclear capacity that retires will likely be replaced with more nuclear, and some coal capacity will need to be replaced over the next 10 years, leaving some room for growth of renewables. Of the \$6.3 billion asset financing of renewables in France forecast for 2020 under the enhanced clean energy scenario, \$5 billion will be spent on wind technologies. The third-largest wind resource in Europe after Germany and the United Kingdom, France plans to increase its wind capacity to meet its commitment under the EU's renewables target.

In the enhanced policy scenario, the cumulative investment potential in France from 2010 to 2020 is projected as \$57 billion, which would leverage installation of 29 GW of renewable energy generating capacity.

France has many of the pieces in place to foster a strong renewable energy sector. The country had \$1.8 billion in clean energy investment in 2009 and has posted an average 98 percent growth rate in this area over the past five years. France has 3.4 GW in installed wind capacity and significant potential as a major photovoltaic (PV) power producer.

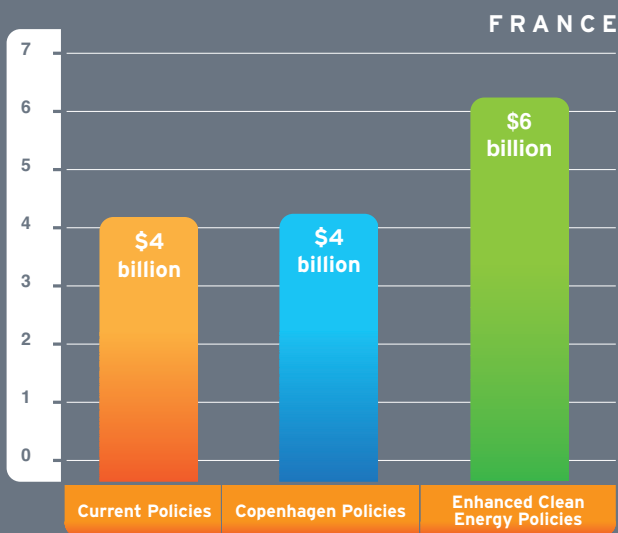
The government has put in place a requirement to source 10 percent of electricity from renewables by

the end of 2010 and has signed on to the EU's cap-and-trade program. It has also adopted the EU's Copenhagen commitment to reduce its emissions by up to 30 percent from 1990 levels. The country recently joined the UK and Germany in saying it would live up to its Copenhagen pledge regardless of what other countries decide to do.

Despite some successes to date, France has not moved as rapidly to embrace renewable energy as it might have, due in part to policy inconsistency. Its tariffs for building integrated PV (BIPV) are among the highest in Europe, for instance, but frequent changes to the legislative framework and rampant bureaucracy create significant obstacles to the industry's growth. Removing these would not only help build new renewable capacity but could also foster a technology development center in France that could attract substantial international venture capital attention. Wind development suffers from an excess of administrative hurdles.

France could also address its centralized electricity system, which has made it difficult for independent players to add new clean capacity. Électricité de France (EDF) is responsible for connecting projects to the grid, and political delays regularly leave project backers and developers alike on hold. Today, several gigawatts of PV projects alone are awaiting connection approvals. To expand capacity rapidly, France needs to address its centralized power system or develop new interconnection processes. Unless these bottlenecks are addressed, all the government's tariffs and incentives for renewable will be for naught.

FIGURE 31. INVESTMENT IN RENEWABLE ENERGY ASSETS, 2020 (BILLIONS OF \$)



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
Efficiency	38% decrease in energy consumption by 2020

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

*Includes investments in venture capital and public markets, and asset finance for all clean energy technologies including biofuels and energy efficiency.



GERMANY

Germany got to the front of the clean energy pack early and continues to be a top performer, thanks to its government subsidies and national policies. Although Germany obtained an early lead and has had significant deployment of renewable energy assets across the country, it is the only G-20 member in which investments decline over the next decade under all policy scenarios. Under the enhanced policies scenario, for example, renewable energy investments in Germany decline 40 percent from 2010 to 2020. These numbers reflect the reality that Germany has had major success in deploying clean energy assets domestically. Still, large amounts of capital will be invested in renewable energy in Germany over the next decade. In the enhanced policy scenario, the cumulative investment potential in Germany over the next decade is projected to be \$208 billion, which would leverage installation of 80 GW of renewable energy generating capacity.

Today, the country sources roughly 29 percent of its electricity from renewables, and is on a path to more than double its solar power generation by the end of 2010. Its generation-based programs and commitment to reduce its emissions at least 20 percent from 1990 levels by 2020 have supported its booming renewable energy generation sectors.

After years of success, Germany has begun to scale back the benefits of its feed-in tariff program, particularly in the solar sector where equipment prices are falling rapidly, making government support less needed. For wind, the country is nearing the saturation point for onshore projects, but opportunities remain for repowering existing projects with newer, more efficient equipment, and substantial potential offshore wind capacity remains. Still, Germany's grid now experiences serious overloads in the northern parts of the country at times because of its large installed wind capacity. This issue has the potential to hamper Germany's otherwise strong clean energy market if not properly addressed.

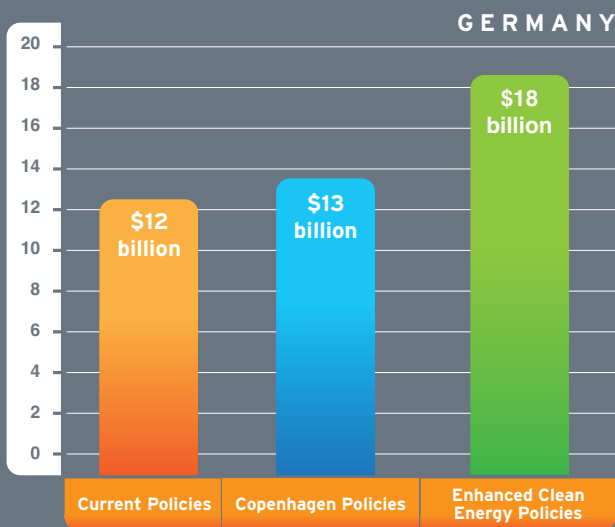
The German government has for years placed economic growth and job creation at the heart of its push to scale up renewable energy, setting clear clean energy goals, and has a generous green stimulus program totaling \$15.3 billion (the fourth highest worldwide). However, its clean energy equipment manufacturing industry, once an exporting powerhouse, has come under increased pressure from Asian competitors.

Germany's clean energy investment decline comes chiefly from a substantial drop in solar investment although it is compensated, in part, by a small increase in wind financing. The decline comes from two factors. First, the high levels of solar in Germany seen today are unsustainable in the long term because at some point demand will run out as the best sites are claimed. Second, costs could fall by 40 percent from 2010 to 2020 due to experience curve effects. The more frequently a task is performed or a product is made, the lower is the cost. So even if the number of solar installations in Germany remains stable, investment will fall as capital expenditure per watt of electricity falls.

While most other countries could consider adopting new, more aggressive policies to promote renewables, Germany faces a different challenge. It is grappling with how to keep current subsidies cost-effective, given market dynamics. In the face of rapidly falling equipment prices, it will have to consider how to make sure that its feed-in tariff program tracks cost curves effectively to prevent a bubble of new installations. The program will continue to focus on distributed generation, offering the added incentive of having high local labor content that would make extending the incentives more palatable to Germans. As an additional incentive for distributed generation development, the country could offer tax breaks, public investment and new building standards for small-scale photovoltaic, biomass and energy efficiency.

At the same time, Germany must address how its grid will manage an unprecedented load of renewable energy. One possibility would be to adopt smart grid technologies to integrate the distributed generation capacity evenly. Commercial-scale power storage projects could also help ease congestion. Finally, plug-in electric vehicles can play a similarly important role in power storage and allow further adoption of renewable capacity.

FIGURE 32. INVESTMENT IN RENEWABLE ENERGY ASSETS, 2020 (BILLIONS OF \$)



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	

*Includes investments in venture capital and public markets, and asset finance for all clean energy technologies including biofuels and energy efficiency.

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

Although in 2009 India was 10th in private investments within the G-20 members, it is on track to climb to third position after China and the United States in the next decade. Under the enhanced policies scenario, investments in India increase by a staggering 763 percent during the decade. Even under current policies, private asset financing in India increases by 369 percent from 2010 to 2020. In the enhanced policy scenario, the cumulative investment potential in India over the decade is projected to be \$169 billion, which would leverage installation of 91 GW of renewable energy generating capacity.

India's strategy is to encourage the development of renewable sources with incentives offered at the federal and state levels. Generous feed-in tariffs have made India a leading nation for wind power. Indeed, 39 percent of the additional investments under the enhanced clean energy policies come from wind financing. There is significant potential in India for power generation from renewable energy sources besides wind, in particular small-hydro, biomass and solar energy which are incentivized through feed-in tariffs.

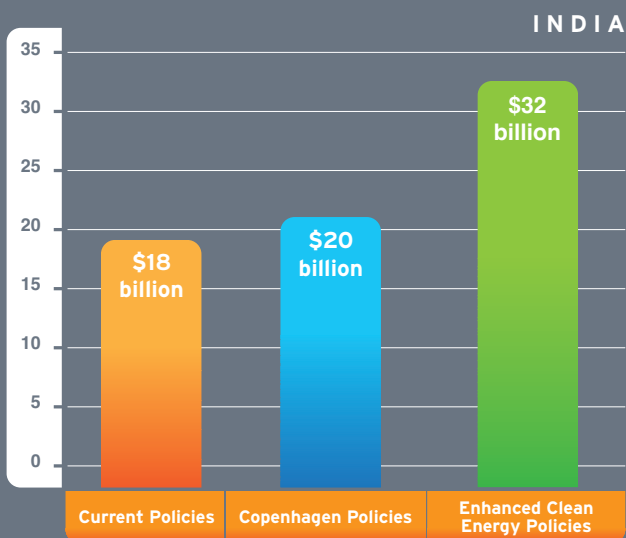
Already, India is one of the leading G-20 members in installed wind with more than 12 GW and recently showed it is not playing favorites, committing to a whopping 20 GW of solar by 2022. The country has feed-in tariff programs for both wind and solar and beneficial accounting procedures and tax incentives for all renewables, which have led to substantial biomass and small-hydro development. Its support

for renewables has also helped it establish a strong renewable energy equipment manufacturing base.

The country has completed rules for credit trading under its renewable electricity standard and designated a central exchange where credits can be bought and sold. Trading is now likely to begin in 2011. India has also expanded its 2012 clean energy targets, increasing the planned installed capacity across all sectors after it met the original targets two years early. These new targets should provide some market certainty for investors until the RES is in place. After Copenhagen, India pledged to reduce its emissions intensity – CO₂ emitted per unit of GDP – at least 20 percent below 2005 levels by 2020 but stressed in its letter to the United Nations that its commitment was not legally binding.

India's slow legislative pace has hindered its market growth. The government should work to improve its procedures for implementing the many clean energy policies and programs. India should also invest heavily in transmission and smart grid technology to improve grid connection for renewable energy projects, which has been a bottleneck for development. The government should also consider extending its wind incentive programs to offshore development and making investments in offshore wind technology development programs to foster a venture capital market and take advantage of its wind resources. Finally, India should invest and incentivize carbon capture and storage technology work and demonstration projects.

FIGURE 33. INVESTMENT IN RENEWABLE ENERGY ASSETS, 2020 (BILLIONS OF \$)



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	✓

1 Includes investments in venture capital and public markets, and asset finance for all clean energy technologies including biofuels and energy efficiency.

2 Incentives primarily through provincial investments

FINANCE AND INVESTMENT (2009) ¹	
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 ²	
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%



INDONESIA

Indonesia has an abundance of geothermal resources and big hopes for the sector. The government aims to source 15 percent of its electricity from renewables by 2025, including 5 GW of geothermal power. Indonesia has 880 megawatts installed in the sector and is slated to issue tenders for projects soon. The country also offers tax incentives for renewable energy developers and hopes to have 0.5 GW of installed solar by 2025. Finally, Indonesia said after the climate summit in Copenhagen that it would reduce its emissions 26 percent by 2020 through various forestry efforts, energy efficiency programs and development of renewables but was not clear on the baseline year it would be using for its commitment.

Despite the government's support, investors and developers have been deterred from the market by concerns about the political and regulatory environment. Indonesia is considering sharing the financial burden of the early stages of geothermal project development to help lower the investment risk, which could go some way toward easing investment concerns. However, more is needed.

Immediate adoption of a renewable electricity standard is a necessary first step toward providing some certainty. The RES could start modestly and then escalate over the coming years.

Indonesia should also be wary of putting all its efforts into its abundant geothermal resources and should offer incentives and possibly specific requirements under its RES for wind and solar development. Finally, carbon capture and storage requirements and programs would help clean up its existing portfolio and would make renewables more attractive.

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

*Includes investments in venture capital and public markets, and asset finance for all clean energy technologies including biofuels and energy efficiency.

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	



ITALY

With high electricity prices, Italy is the first major country in which solar power is expected to reach “grid parity” with other electricity sources, meaning that within several years, generating a kilowatt-hour from a solar module will be directly cost competitive with buying that power from the grid at market prices. Accordingly, the government has reduced the current solar feed-in tariffs in 2011, but even with these cuts, Bloomberg New Energy Finance’s analysis indicates Italy will be the most attractive market for photovoltaic (PV) solar over the next few years. As such, Italy occupies a leading position for clean energy finance and investment in our scenarios. Under the enhanced policies scenario, Italy is in sixth position – attracting investments in 2020 worth \$10 billion – which is almost equally balanced between solar and wind. In the enhanced policy scenario, the cumulative investment potential in Italy from 2010 to 2020 is projected to be \$90 billion, which would leverage installation of 47 GW of renewable energy generating capacity.

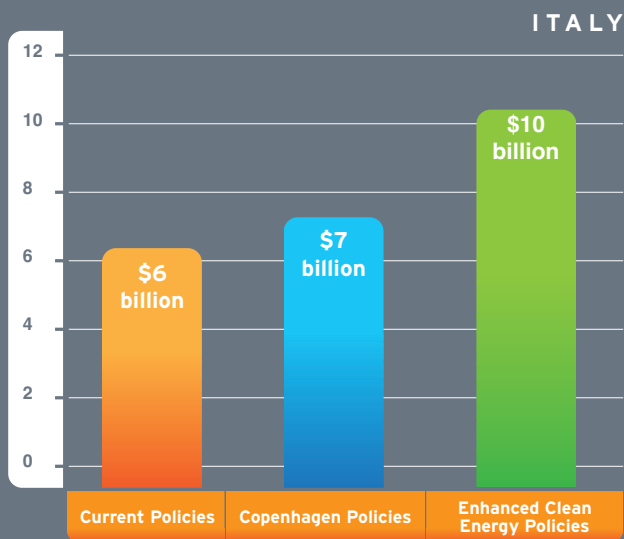
To date, Italy’s feed-in-tariffs have helped it to add 2.4 GW in solar capacity, 1.1 GW in biomass and 4.8 GW in wind. The current incentives, coupled with potential for PV grid parity, mean that solar has a potentially very bright future in Italy. The government has said it will source 25 percent of its power from renewables by the end of this year and has committed to reducing its emissions by at least 20 percent from 1990 levels by 2020 and possibly by as much as 30 percent, as part of the EU’s Copenhagen pledge.

By streamlining the permitting process, the country has paved the way for developers to get larger projects built rapidly, though only time will tell how effective this measure really is. The Italian wind market is now the third strongest in Europe and the biomass sector is thriving, but they are at risk because the government is debating a change to the green certificate system that would drive prices down and make revenue for developers more volatile.

The PV sector is sheltered from these changes, because it is governed by a different regime and Italy is on track to become the world’s most profitable PV market in 2011, according to Bloomberg New Energy Finance. This could lead to unsustainable growth and a risk of creating a boom-bust cycle. The government has introduced moderate cuts to its feed-in tariff incentives for solar for 2011.

To foster strong but manageable growth in renewables, Italy can continue its feed-in tariff incentives accompanying the sector to grid-parity, but adjust them to better track solar system costs. The government might also consider offering additional tax breaks and financing programs to ensure that potential solar system buyers such as commercial, industrial and residential property owners do not simply defer purchases once the tariffs are phased out.

FIGURE 34. INVESTMENT IN RENEWABLE ENERGY ASSETS, 2020 (BILLIONS OF \$)



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	

*Includes investments in venture capital and public markets, and asset finance for all clean energy technologies including biofuels and energy efficiency.

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

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



JAPAN

Japan is a country of clean energy contradictions. The country placed 15th among the G-20 in 2009 investments with just under \$1 billion but remained a solar leader and now has more than 2.6 GW installed capacity. Japan's terrain and large population make large-scale projects costly. Nevertheless, the country is a hotbed of rooftop PV installations and has said it aims to eventually garner as much as 28 GW in solar capacity by 2020. Japan is also still a technology development center and has made big moves into the biomass and wind energy sectors, with installed capacities of 2 GW each. In the enhanced policy scenario, the cumulative investment potential in Japan from 2010 to 2020 is projected as \$66 billion, which would leverage installation of 35 GW of renewable energy generating capacity.

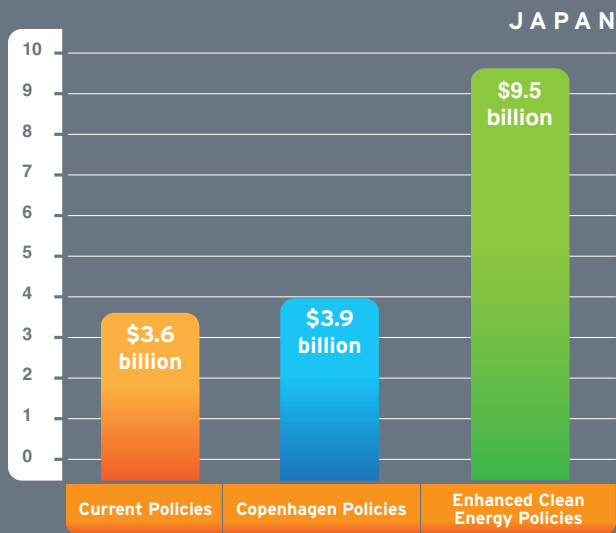
To see any kind of clean energy investment growth over the next decade, Japan must adopt strong clean energy policies. Under an enhanced policies scenario, investments rise 125 percent to \$9 billion, of which two-thirds will go toward solar power. Absent additional policies, renewable energy asset financing in Japan will be modest over the next 10 years.

With high hopes of rebuilding a strong, growing and low-carbon economy, Japan has started to shape and implement its clean energy strategy. A subsidy for residential photovoltaic (PV) solar installations of \$777 per kilowatt-hour of equipment and a surplus PV electricity buyback program of \$0.53 per kilowatt-hour has created a boom, attracting foreign manufacturers into Japan.

Japan's recently adopted solar feed-in tariff boosted domestic shipping 138 percent and 98 percent in the second and third quarters of 2010, respectively, results so impressive that the government has said it may extend the program to other sectors, possibly as soon as 2012. The federal renewable electricity standard requires 13.4 GW of renewables by 2014 – a target Japan is well on track to meet. The government intends to replace its renewable electricity standard with an extended feed-in tariff program. The government is also considering establishing a target 25 percent reduction in emissions from 1990 levels by 2020 in place of a goal to lower emissions to 1990 levels by 2020.

Along with long-term, legislated renewable energy targets and carbon reduction requirements, the government needs to focus on how to integrate vast distributed energy resources. In terms of technology, the government in collaboration with industry has committed more than \$1.5 billion for "smart community" pilot experiments from 2010 to 2014. Already Japanese manufacturers such as Panasonic and Hitachi can provide technological solutions from the generation side, all the way down to the end consumer, but the existing regulatory framework does not provide any incentive for Japanese utilities to deploy such technologies. As such, Japan's success within this area is less a matter of technology and more a question of having favorable regulatory reform.

FIGURE 35. INVESTMENT IN RENEWABLE ENERGY ASSETS, 2020 (BILLIONS OF \$)



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 ₂

*Includes investments in venture capital and public markets, and asset finance for all clean energy technologies including biofuels and energy efficiency.



MEXICO

Mexico posted \$2.1 billion in renewable energy investment in 2009, but development to date has occurred in the absence of policies needed to encourage a more substantial influx of new capital. Much of the development has been located in remote areas or regions with unstable grids, so the new capacity has not actually replaced grid-connected fossil fuel generation. Solar has been used to power remote villages. The country's eight operating wind projects feed into the national grid but wind's expansion has been hampered by lack of transmission capacity to the isthmus region.

Mexico's power generation infrastructure is heavily controlled by state utility Comisión Federal de Electricidad (CFE). As a result, there are few opportunities for private capital to participate in expanding clean energy capacity. CFE manages the current tender process for new power contracts and dictates which kinds of new power-generating plants should be brought on line.

Mexico has established voluntary 2012 targets for renewables that would result in roughly 4.8 GW in cumulative capacity added, including 2.7 GW in wind. However, the targets do not provide market certainty, nor do they aim to replace large-scale fossil fuel-fired power plants. Under its Copenhagen commitment, Mexico said it

would reduce its emissions up to 30 percent from business as usual emissions in 2020 but stressed that the pledge hinged on financial and technological support from the developed world.

With few incentive programs in place, Mexico's policy framework is not strong enough to encourage substantial renewable energy development. Key decisions for adding more clean energy capacity now lie in the hands of top management at CFE and, to a somewhat lesser degree, the national oil company, Pemex. These officials will largely determine whether Mexico meets its short-term goals of adding clean energy capacity and its longer-term commitment to reduce emissions.

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%
Key Renewable Energy Sectors	
Geothermal	965 MW
Small-Hydro	377 MW

KEY CLEAN ENERGY TARGETS (2012)	
Wind	2,726 MW
Geothermal	1,036 MW

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.

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	

*Includes investments in venture capital and public markets, and asset finance for all clean energy technologies including biofuels and energy efficiency.



SOUTH AFRICA

South Africa originally planned to release its draft climate change policy prior to the Copenhagen climate summit and now says it will produce it sometime in late 2010. During the climate summit in Copenhagen, President Jacob Zuma announced that the country would cut its emissions 34 percent below its business-as-usual projection by 2020.

In 2003, South Africa outlined its first strategy to expand clean energy capacity. At that time, the Department of Energy (DoE) set out to produce 10,000 gigawatt-hours from renewables to meet 4 percent of the country's energy needs by 2013. However, the only grid-connected renewable energy plants on line are three demonstration wind projects with a total capacity of 10 megawatts.

In a bid to address the slow uptake, national energy regulator Nersa introduced South Africa's first renewable energy feed-in tariff ("Refit") in March 2009. Wind, landfill gas, small-hydro and solar thermal electricity generation were the first four technologies to qualify to receive the benefit of the tariff with Nersa later adding five others. In recent months, the DoE has become more ambitious in seeking new clean energy capacity. It now targets 12.25 GW by 2013, mostly from independent power producers with the balance from state utility Eskom's 0.1 GW Sere wind farm and 0.1 GW solar projects.

While South Africa's plans are now more ambitious, it has yet to set aside sufficient funds to support its feed-in tariff program. There is the possibility that some portion could be raised from emissions taxes such as the carbon vehicle tax, which came into effect in September, 2010. The National Treasury estimates that this tax will raise about \$60 million in the 2010/2011 fiscal year.

Since establishing Refit in 2009, South Africa has gathered a strong pipeline of project proposals, but no licenses have been awarded due to a slow permitting process. As of August 2010, Nersa had yet to finalize terms of standard power purchase contracts with renewable energy projects and not completed selection criteria for independent power producers to provide the power.

South Africa's adoption of clean energy capacity would certainly accelerate if it could streamline its permitting procedures to cut wait times for developers and financiers looking to build projects. The government could also expand the reach of its feed-in tariff program to include smaller-scale power generation such as 0.2 GW wind projects. Finally, it could set aside the funds necessary to underwrite Refit and spur project build-out.

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

KEY INVESTMENT INCENTIVES	
Wind, Solar, Small-Hydro	Feed-in tariffs

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	

*Includes investments in venture capital and public markets, and asset finance for all clean energy technologies including biofuels and energy efficiency.



SOUTH KOREA

South Korea has big plans for its renewables sector, which had only minimal investment - just \$20 million in 2009 placing it 19th among G-20 members. The country has roughly 3.5 GW installed in each of its wind and solar sectors but aims to hit 2.25 GW in wind development and 1.3 GW in solar capacity by 2011, which together would make up 5 percent of its total energy supply. Under its economic stimulus package, South Korea offered \$27.8 billion for clean energy. In the enhanced policy scenario, the cumulative investment potential in South Korea from 2010 to 2020 is projected to be \$40 billion, which would leverage installation of 22 GW of renewable energy generating capacity.

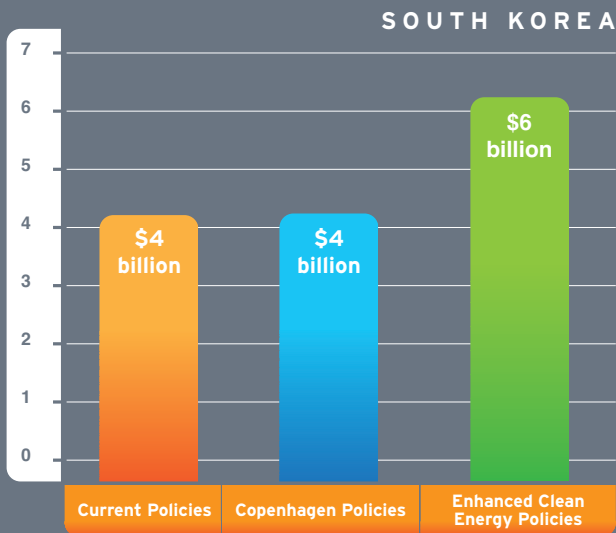
The government supports renewable energy as a way to reduce reliance on oil imports. In early 2010 South Korea passed a government bill to increase the country's consumption of renewable energy and to support solar and wind power. If South Korea follows through on its ambitions, it could attract \$6 billion in clean energy asset investment by 2020, double the \$3 billion projected for 2010.

The country has adopted a federal renewable electricity standard that will start in 2012 and will require companies to source 10 percent of their electricity from renewables by 2022. South Korea has also taken steps to ensure that government support will continue in the long-term with a law requiring that at least 2 percent of its GDP be spent on clean energy research and development.

Finally, a pilot cap-and-trade program is being developed and the government has committed to a 4 percent reduction in emissions from 2005 levels. South Korea made the emission reduction pledge following the Copenhagen conference and has said it would be equivalent to a 30 percent reduction from business-as-usual emissions by 2020.

Its promises of spending, regulation and carbon pricing have already begun to draw the private sector into the market at unprecedented levels, with more than \$2 billion already pledged and major investments made in technologically advanced renewable energy equipment, such as large wind turbines and fourth generation PV. More than anything, what South Korea can do now is keep its promises. The government has laid the groundwork for a boom in clean energy spending but must now make its long-term RPS and carbon emission reduction goals official through legislation. It must spend all the money it has said it will, including a \$24 billion smart grid investment and the 2 percent of GDP for research. Following through on its big plans should provide the incentives and the certainty that private investors and developers need to want a stake in South Korea's market.

FIGURE 36. INVESTMENT IN RENEWABLE ENERGY ASSETS, 2020 (BILLIONS OF \$)



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

*Includes investments in venture capital and public markets, and asset finance for all clean energy technologies including biofuels and energy efficiency.



TURKEY

Turkey had \$1.6 billion in clean energy investments in 2009 and its five-year growth rate is the highest among G-20 members at more than 178 percent. Thanks to regulatory policies and a potential feed-in tariff program, that growth could well continue. Turkey sources less than 1 percent of its power from renewables, including more than 8 GW from wind. The country has adopted an aggressive renewable electricity standard (RES) requiring it to increase renewable energy capacity to 25 percent by 2020. As a result, Turkey could add 8-10 GW wind by that time, though other policies clearly will be required to achieve those results.

Turkey did not submit a post-Copenhagen commitment regarding carbon emission reductions and rumors briefly circulated that the government had abandoned its renewable energy feed-in tariff program. Still, a wide-ranging energy bill is pending in parliament. If passed, it would offer generous rates for onshore and offshore wind, solar thermal electricity generation and photovoltaic solar, geothermal, biomass and marine energy. Taken with the RES, this program could provide much-needed certainty to draw more investors to the market.

Excessive red tape and bureaucracy have also hindered rapid growth of renewables, and the new legislation is poised to address that as well. Streamlining permitting and connection procedures will allow Turkey to avoid the backlogs that have developed in some other countries. Meanwhile, smart grid and power storage investments and demonstration projects will help Turkey incorporate large amounts of renewables into its grid. The country should also consider carve-outs and financing programs for distributed generation under its tariff program.

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

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	

*Includes investments in venture capital and public markets, and asset finance for all clean energy technologies including biofuels and energy efficiency.



UNITED KINGDOM

As an island nation, the United Kingdom has powerful natural resources for wind and marine energy. Yet historically, it has lagged behind other EU Member States such as Spain and Germany in building renewable energy capacity. For the first time, however, the United Kingdom took third place in renewable energy investment in 2009 thanks to a surge in financing of offshore wind projects in the North Sea. Under all future scenarios, the United Kingdom is poised for significant growth in private investments in renewable energy assets. Under current policies, growth of almost 185 percent is anticipated. With enhanced policies, the United Kingdom could see annual investments grow by 260 percent. In the enhanced policy scenario, the cumulative investment potential in the United Kingdom from 2010 to 2020 is projected to be \$134 billion, which would leverage installation of 44 GW of renewable energy generating capacity.

Like Germany, the United Kingdom is subject to EU environmental commitments including the target of 20 percent of energy production from renewable energy sources by 2020 and reducing carbon emissions by 20 percent from 1990 levels by 2020. The United Kingdom's renewable energy strategy has focused on wind power, with significant funding dedicated to offshore wind development. This trend is projected to continue.

The United Kingdom's National Renewable Energy Action Plan submitted to the European Commission in June said the country "needs to radically increase its use of renewable energy" by producing 15 percent of its

energy from clean sources by 2020, up from 1.5 percent in 2005. The recent change in government does not appear to have dimmed overall support for meeting these goals, although the government's climate change adviser, the Committee on Climate Change, has advised the Conservative-Liberal Coalition to rein in proposals to raise its 15 percent target.

The United Kingdom has focused heavily on wind because of its strong onshore and offshore resources. The United Kingdom was one of the first countries to introduce wave and tidal stream devices to its waters. In October, the government shelved plans for a tidal power plant in England's Severn Estuary, which could have provided as much as 5 percent of the nation's power. However, enhanced incentives under the Renewables Obligation in Scotland continue to support the development of wave and tidal power in the United Kingdom. The new government has also pledged measures to ramp up energy from waste through anaerobic digestion. In its October spending review the United Kingdom committed up to £1 billion for the development of four carbon capture and storage demonstration plants.

The United Kingdom recently adopted a feed-in tariff program for small scale photovoltaic (PV) solar development, though given its stronger wind and other natural resources, this might prove too costly. The new coalition government also plans to establish a full feed-in-tariff system bringing in large-scale generators of energy from renewable sources, though no timeframe for its introduction has been

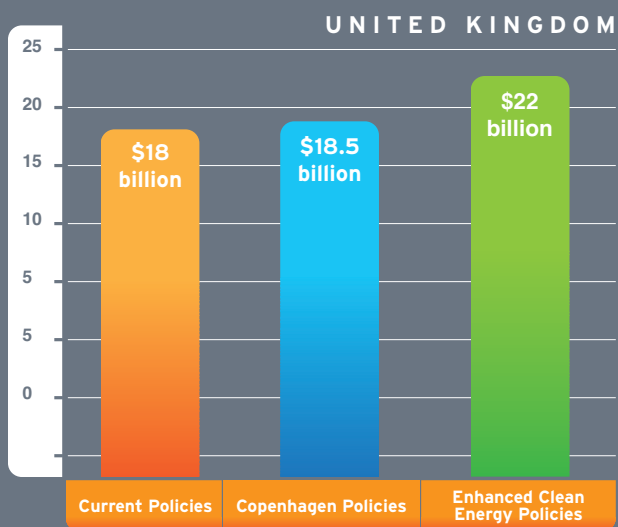
announced. In addition, the Renewable Heat Incentive, a tariff plan aimed at incentivizing the generation of heat from renewable sources, is due to take effect in April 2011.

The government is working to bring the technologies listed in its Code for Sustainable Homes, which rate the sustainability of new construction against energy efficiency and environmental criteria, into line with those in the EU Renewable Energy Directive. It has also committed to expedite smart grid and smart meter rollout.

Rising electricity prices and growing public awareness of climate issues should aid in the implementation of these programs.

To boost investment in its commercial-scale renewable energy sector, the government can consider reforming its Renewable Obligation program, which energy market participants use to comply with the country's overall clean energy targets. Forecasting prices of tradable credits under the program is a complicated endeavor, making it difficult to accurately estimate project capital cost requirements and secure financing. A more transparent system would offer the lower cost of capital that offshore wind project developers in particular desperately need. Beneficial accounting procedures and incentives for commercial developers, paired with injections from infrastructure banks for smaller developers, would also help ease entry into the market and make development more economical.

FIGURE 37. INVESTMENT IN RENEWABLE ENERGY ASSETS, 2020 (BILLIONS OF \$)



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

KEY INVESTMENT INCENTIVES	
Renewable Energy Electricity	Renewable energy exempt from £4.3/MWh climate change levy
Renewable Energy	Renewable energy standard, with permit trading

*Includes investments in venture capital and public markets, and asset finance for all clean energy technologies including biofuels and energy efficiency.



UNITED STATES

Because its economy leads the world, the United States is a clean energy leader, but unless it adopts additional policies, it will continue to fall short of its potential. While the United States retains second place in all scenarios, there is a huge gap between its investment levels and those of China. Under current policies, U.S. clean power investments increase to \$27 billion, about \$23 billion less than the world leader, China. In contrast, if the United States adopts ambitious clean energy policies, annual investments increase by 237 percent over 2010 levels and reach \$53 billion annually. In the enhanced policy scenario, the cumulative investment potential in the United States over the next decade is projected as \$342 billion, which would leverage installation of 171 GW of renewable energy generating capacity.

To date, efforts to promote renewable energy have mostly been done at the state, rather than federal, level, leading to a hodgepodge of policies with varying degrees of ambition across the country. For instance, more than 30 states have Renewable Electricity Standards in place requiring certain proportions of energy to be produced using renewable energy sources. However, no two programs are alike, with variations in targets, timing, carve-outs, eligible technologies, compliance penalties and procurement eligibility. Since 2009, two prominent proposals

for a federal RES that would provide uniformity have emerged from the House and Senate, but neither received final approval.

Continued policy uncertainty at the federal level has forced states to lead the way in establishing pro-renewable energy policies. Most notably, California's Solar Initiative subsidy plan has been highly successful with approximately 900 MW of photovoltaic solar now installed there. In addition, the state has stepped up its renewable electricity standard (RES) to require that 0.1 in 0.3 gigawatt-hours of generation in 2020 come from clean sources.

At the federal level, the United States recently finalized its fuel efficiency rules for automakers and laid out regulations governing the second phase of its renewable fuels standard, which mandates that 36 billion gallons of biofuels be mixed into the overall United States fuel supply by 2022. In February 2009, Congress approved the American Recovery and Reinvestment Act (the "stimulus bill") allocating \$66 billion in funding for manufacturing, project build-out, and research and development of clean energy technologies.

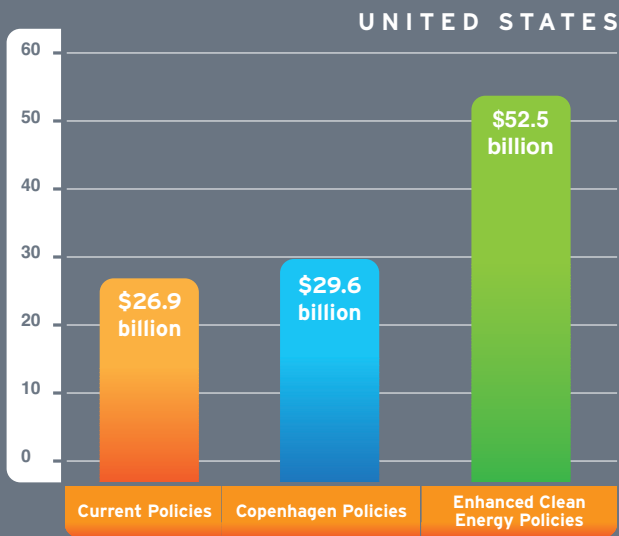
Despite successful efforts to subsidize the supply of clean energy, the United States has done virtually nothing at the national level to boost demand for renewable energy. This has

proven particularly difficult given the current economic environment and historically low natural gas prices. Congress adjourned before the 2010 elections after failing to pass either a national cap-and-trade program to cut domestic carbon emissions or a national RES setting clean energy targets. In the short term, both are critical to the United States cutting emissions and building a successful clean energy economy.

On the international stage, the United States has committed to an emissions reduction "in the range of 17 percent" below 2005 levels by 2020 following the climate summit in Copenhagen. This pledge was made by President Barack Obama and reflects the commitment made in the Waxman-Markey bill passed by the United States House of Representatives in June 2009. That legislation later languished in the United States Senate.

Above all, the United States needs policy certainty to draw in cautious developers, manufacturers and investors who have historically been reluctant to make major investments in the country. First, Congress can pass a national RES and legislation that puts a price on carbon. The federal government could also extend the production-based incentives, beneficial accounting rules and research programs created under the economic stimulus programs.

FIGURE 38. INVESTMENT IN RENEWABLE ENERGY ASSETS, 2020 (BILLIONS OF \$)



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) ¹	
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

KEY CLEAN ENERGY TARGETS (2022)	

KEY INVESTMENT INCENTIVES ²	
Wind, Solar	Production Tax Credit / Investment Tax Credit
Cleantech	Federal loan guarantees
Wind, Solar, Power Storage	Federal Manufacturers Tax Credit

¹ Includes investments in venture capital and public markets, and asset finance for all clean energy technologies including biofuels and energy efficiency.

² Incentives provided by local, state and federal governments.



REST OF THE EUROPEAN UNION (EU-27)

The remaining European Union members not profiled individually in this report account for \$14.3 billion in clean energy investments in 2010. All members have agreed to source 10 percent of their electricity from renewables by the end of 2010 and committed to reducing their emissions to at least 20 percent below 1990 levels by 2020. The cuts could be as deep as 30 percent depending on pledges from other developed nations. Several EU members also have domestic feed-in tariffs and green certificate programs. That is why private investment in clean energy assets should grow by at least 20 percent over the next decade. With enhanced policies, annual private investments in these countries could double by 2020. In the enhanced policy scenario, the cumulative investment potential in the rest of the EU over the next decade is projected as \$216 billion, which would leverage installation of 110 GW of renewable energy generating capacity.

Across the continent, the European Investment Bank (EIB) has played a key role in the sector, increasing its support from \$2.2 billion in 2008 to \$4.2 billion last year. Meanwhile, the EU affords developers the benefits of a free economic trade zone but also allows financiers to enter the smaller markets while enjoying currency stability and financial support from the EIB and stronger EU nations.

Each EU Member State is expected to have its own National Renewable Energy Action Plan in place—and as of mid-November 2010—four out of the required 27 documents were still missing. Among the smaller nations that did submit plans, many in Eastern Europe said they plan to make

heavy use of biomass burning to meet their clean energy goals.

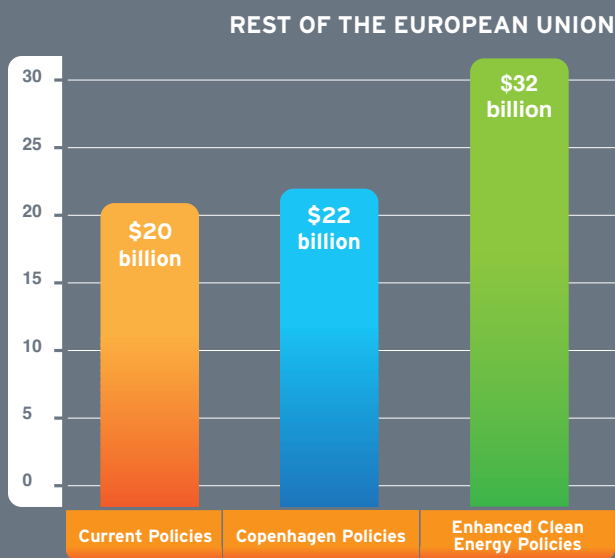
More recently the EU has begun to sharpen its legislative focus on energy efficiency policies. In its Energy Strategy 2020, published in November, 2010, the EU Commission said Member States had not yet gone far enough in legislating to meet a non-binding target of a 20 percent reduction in primary energy use compared with projected levels by 2020. It urged members to focus on implementing efficiency policies in existing building stock and the transport sector, and alluded to a possible revision of the EU energy taxation directive as well as improved standards for efficiency in industry and leadership from the public sector. This should be achieved through the introduction of legislation at the EU level over the next 18 months.

While challenging each country to set a domestic plan is laudable, the EU could seek a more regional approach if it hopes to make best use of existing natural resources, regardless of their location. One way to foster best use could be to establish improved cross-border trading of clean energy and regional renewable electricity standards that apply across borders.

Finally, more locally, all members would do well to focus on very small-scale incentives, such as tariffs and simple connection procedures for distributed generation, smart metering programs, preferential mortgages for homeowners who install renewable energy systems, and net metering programs for utilities.



FIGURE 39. INVESTMENT IN RENEWABLE ENERGY ASSETS, 2020 (BILLIONS OF \$)



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	✓

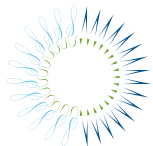
FINANCE AND INVESTMENT (2009)*	
Total Investment	\$21.2 billion
G-20 Investment Rank	N/A
Percentage of G-20 Total	19%
5-Year Growth Rate	81%

INSTALLED CLEAN ENERGY (2009)	
Total Renewable Energy Capacity	34.7 GW
Total Power Capacity	N/A
Percentage of G-20 Total	12%
5-Year Growth Rate	12%
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

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

*Includes investments in venture capital and public markets, and asset finance for all clean energy technologies including biofuels and energy efficiency.



THE
PEW
CHARITABLE TRUSTS

2005 Market St., Suite 1700
Philadelphia, PA 19103-7077
Tel: 215-575-9050
Fax: 215-575-4939