Global Status of Renewable Energy Markets, Industry and Policies and Prospects for Japan

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Fourth Annual
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Janet Sawin

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RENEWABLES GLOBAL STATUS REPORT

2009 UPDATE

自然エネルギー世界白書

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翻訳：NPO法人 環境エネルギー政策研究所（ISEP）

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REN21 Renewable Energy Policy Network for the 21st Century

RENEWABLES 2007
GLOBAL STATUS REPORT

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（翻訳：NPO法人 環境エネルギー政策研究所）

RENEWABLES 2010 GLOBAL STATUS REPORT

Review Draft

April 26, 2010

All information contained in this draft is preliminary and subject to revision

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Figure 1. Renewable Energy Share of Global Final Energy Consumption, 2008

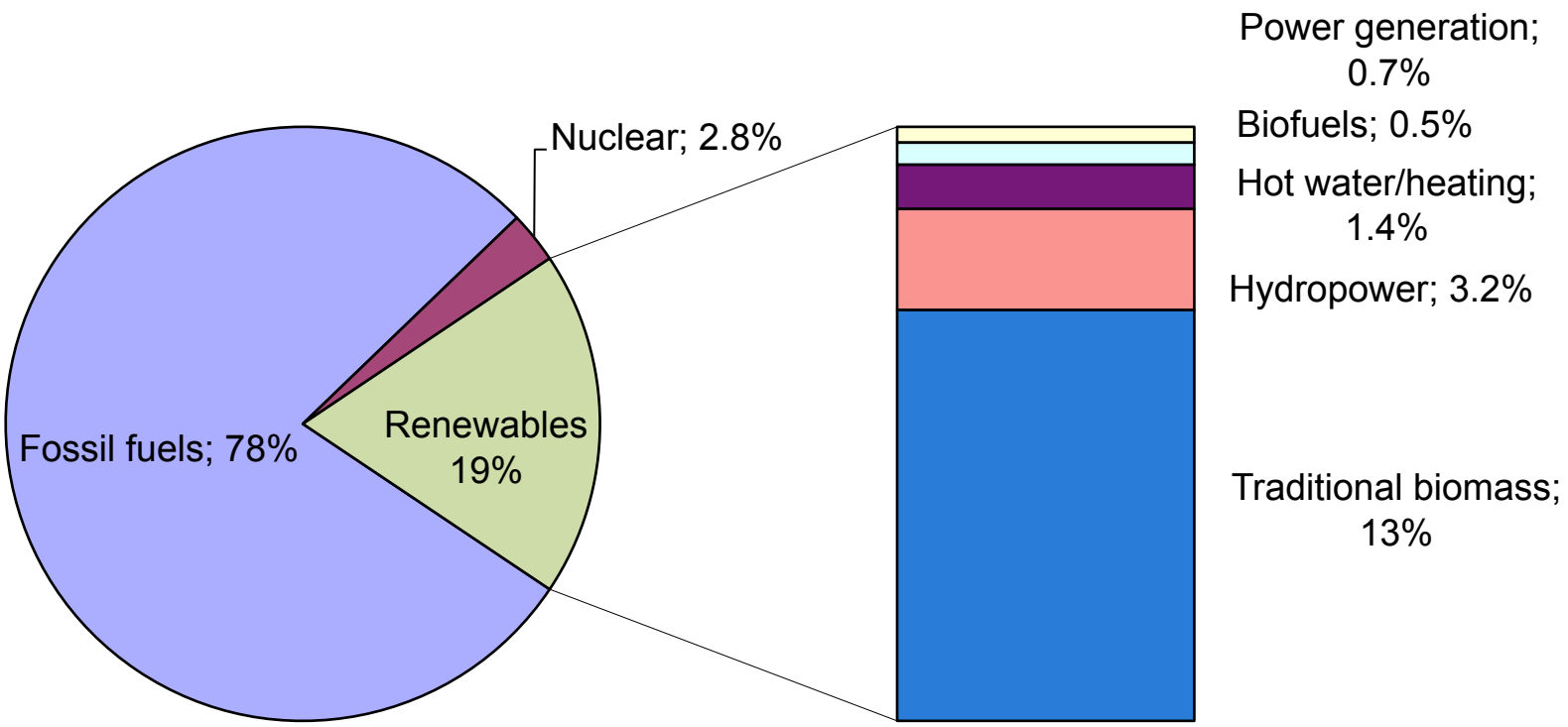


Figure 2. Share of Global Electricity from Renewable Energy, 2008

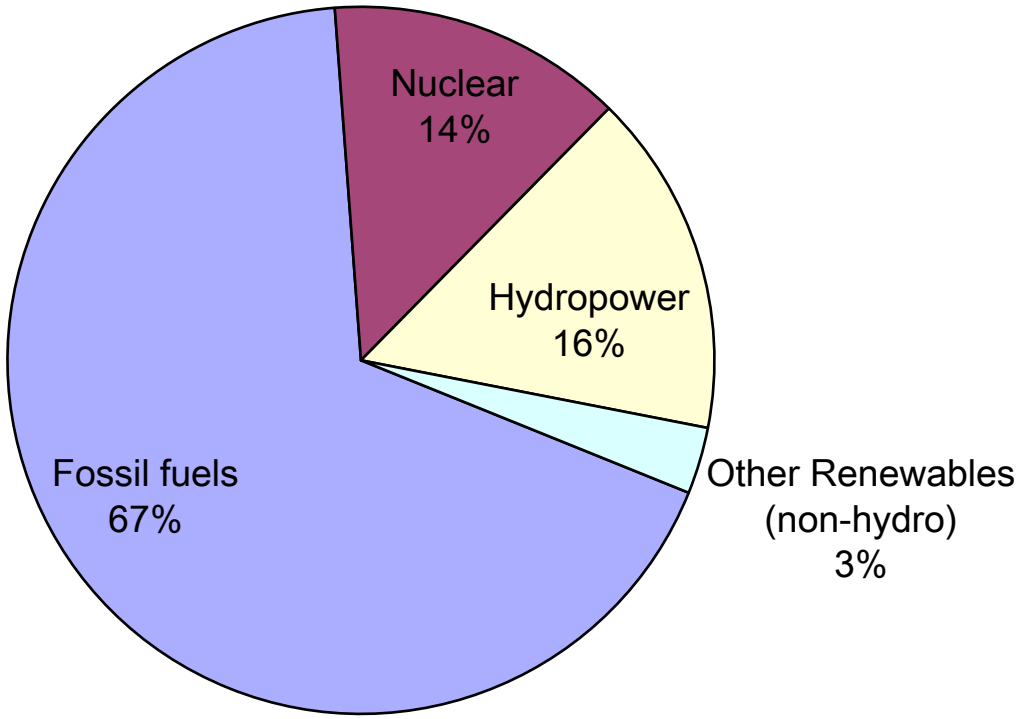
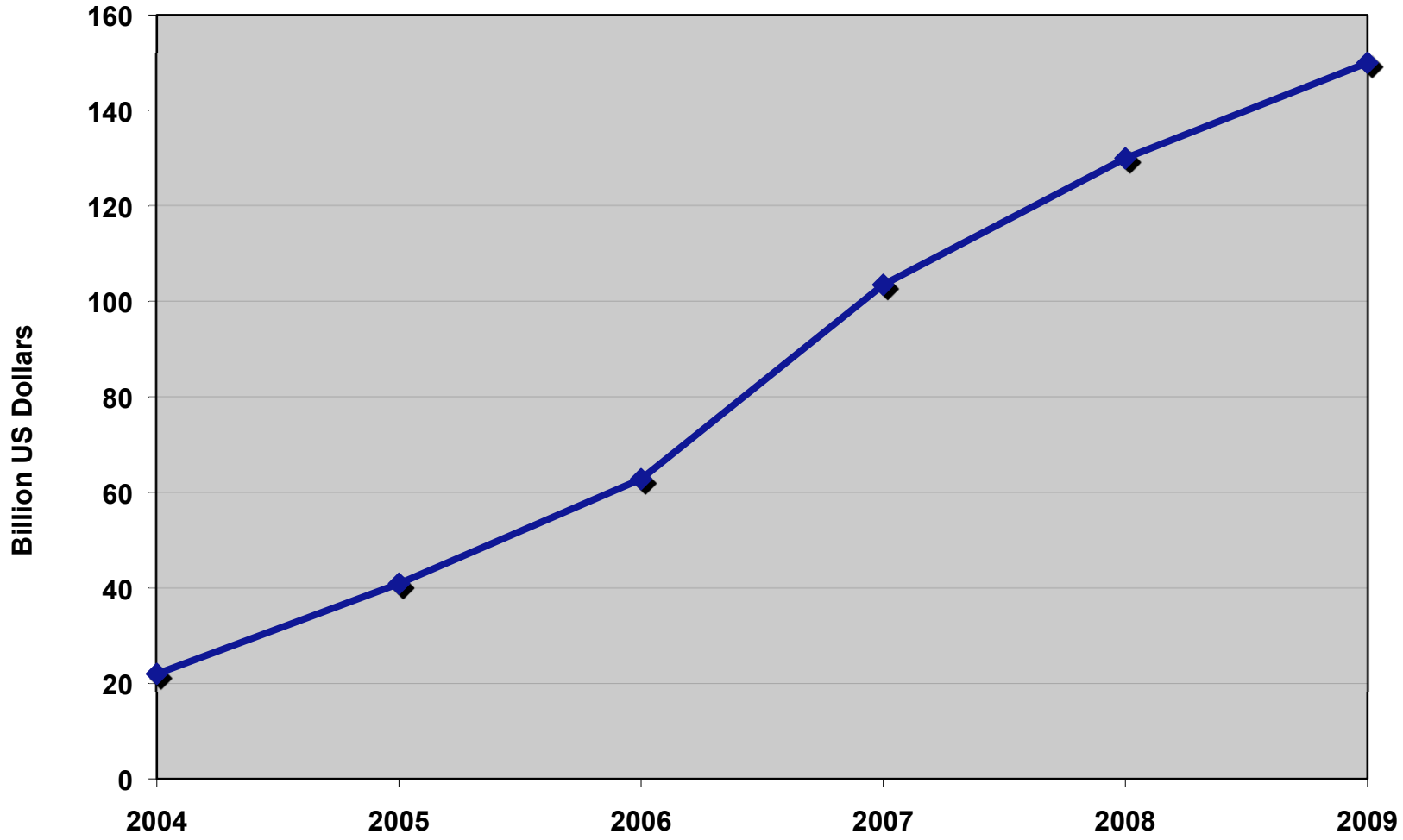


Figure 12. Annual Investment in New Renewable Energy Capacity, 2004–2009



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Annual Investment – Technology Shares (2008)

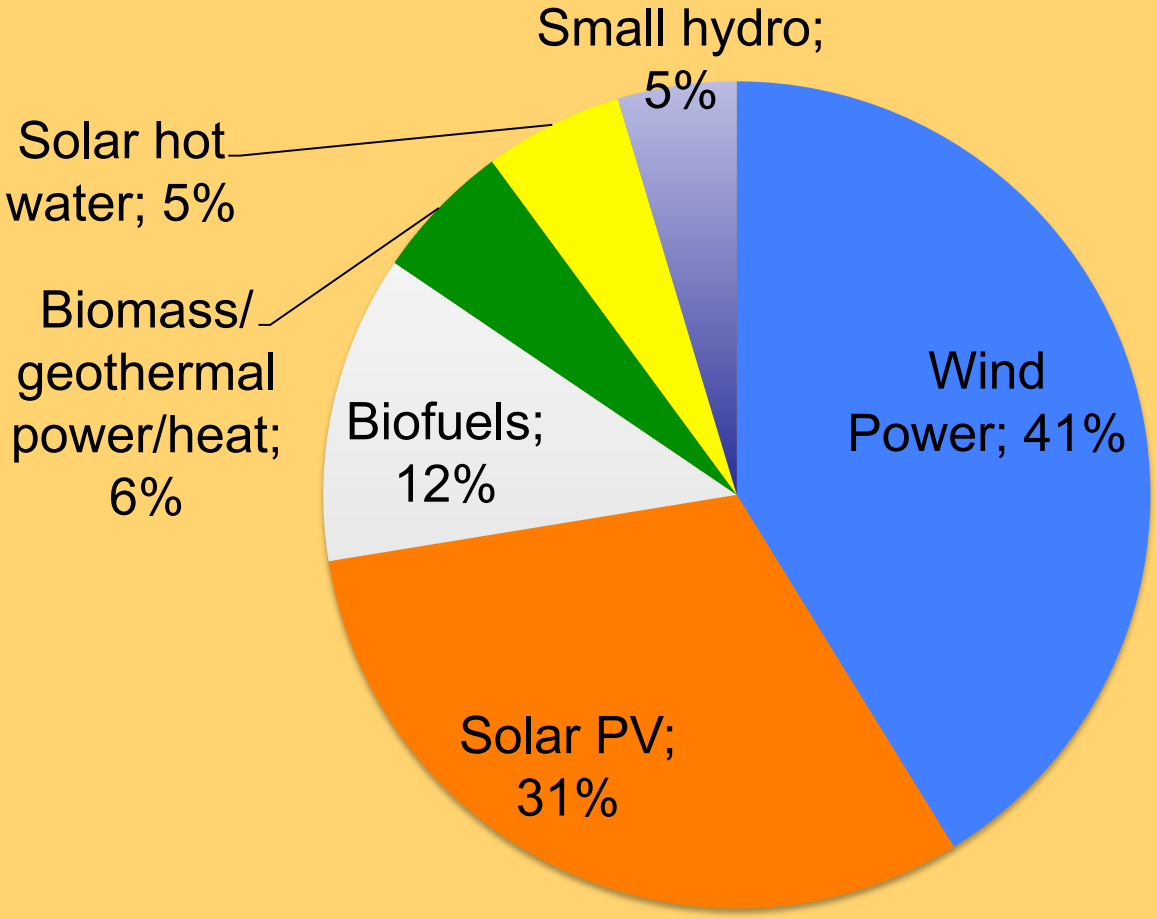
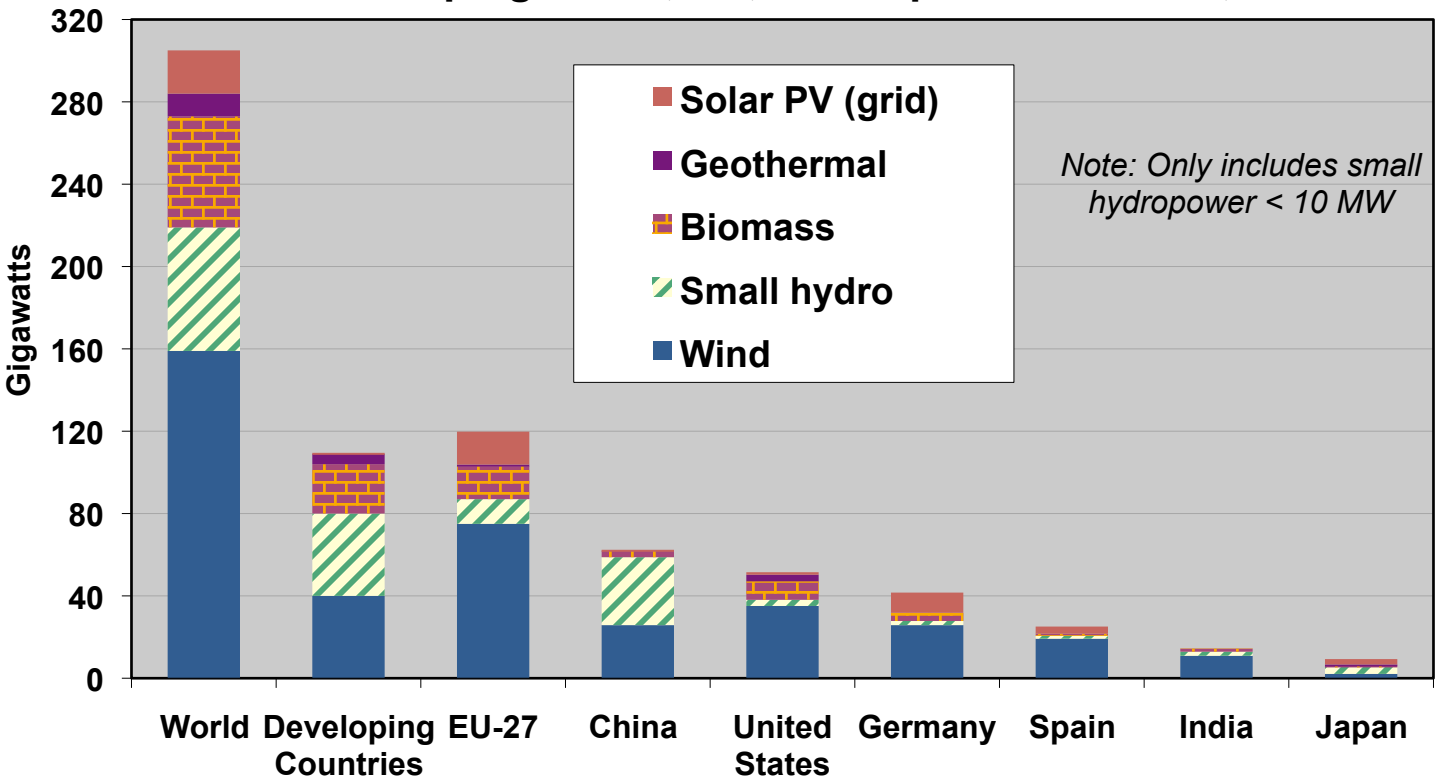


Figure 4. Renewable Power Capacities: Developing World, EU, and Top Six Countries, 2009



Power capacity milestone in 2008

For the first time,
both the United States and the European Union
added more power capacity from renewables
than from conventional sources
(gas, coal, oil and nuclear)

(Note, however, that annual power generation from a unit of renewable capacity is typically less than from conventional capacity)

Figure 5. Wind Power, Existing World Capacity, 1996–2009

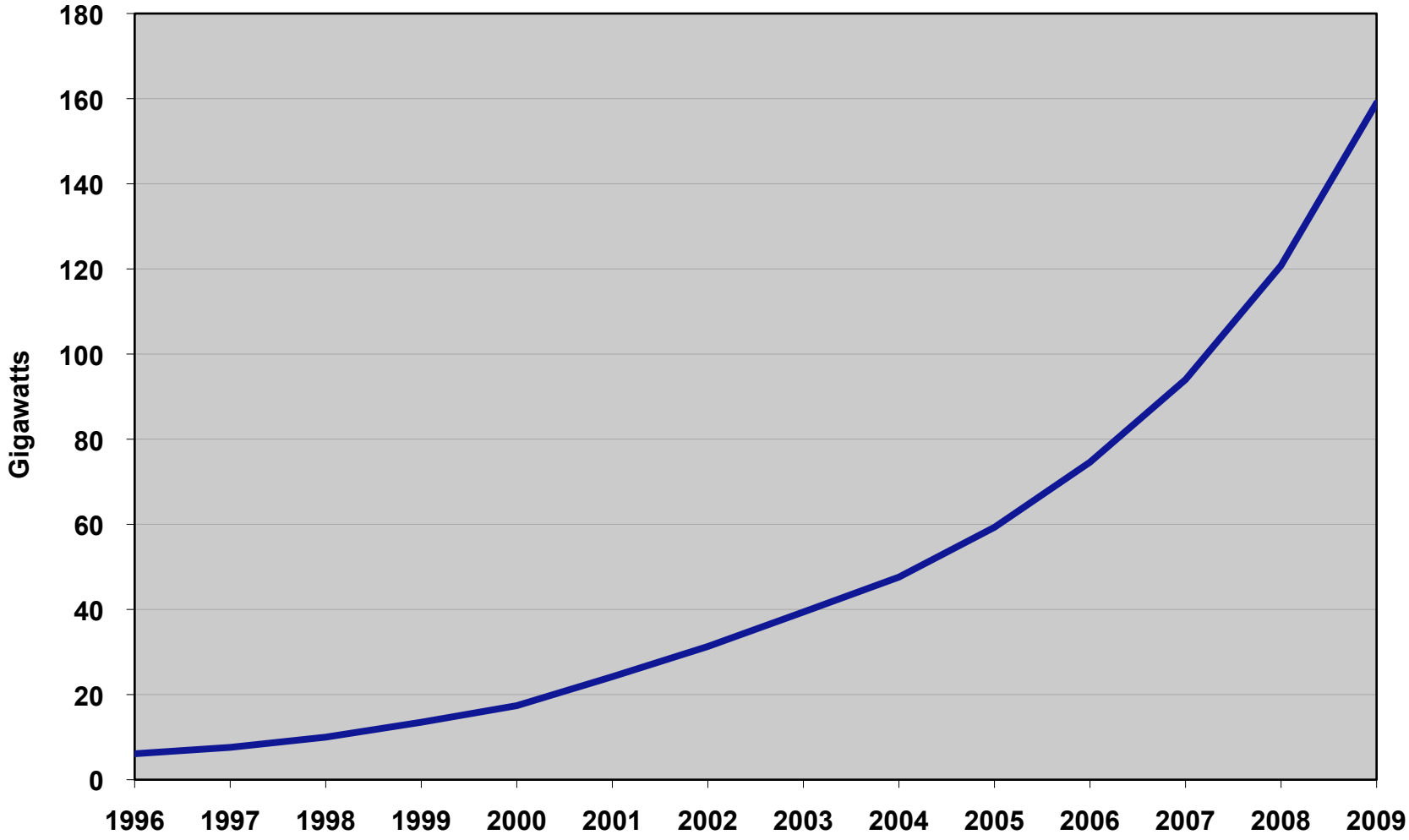


Figure 6. Wind Power Capacity, Top 10 Countries, 2009

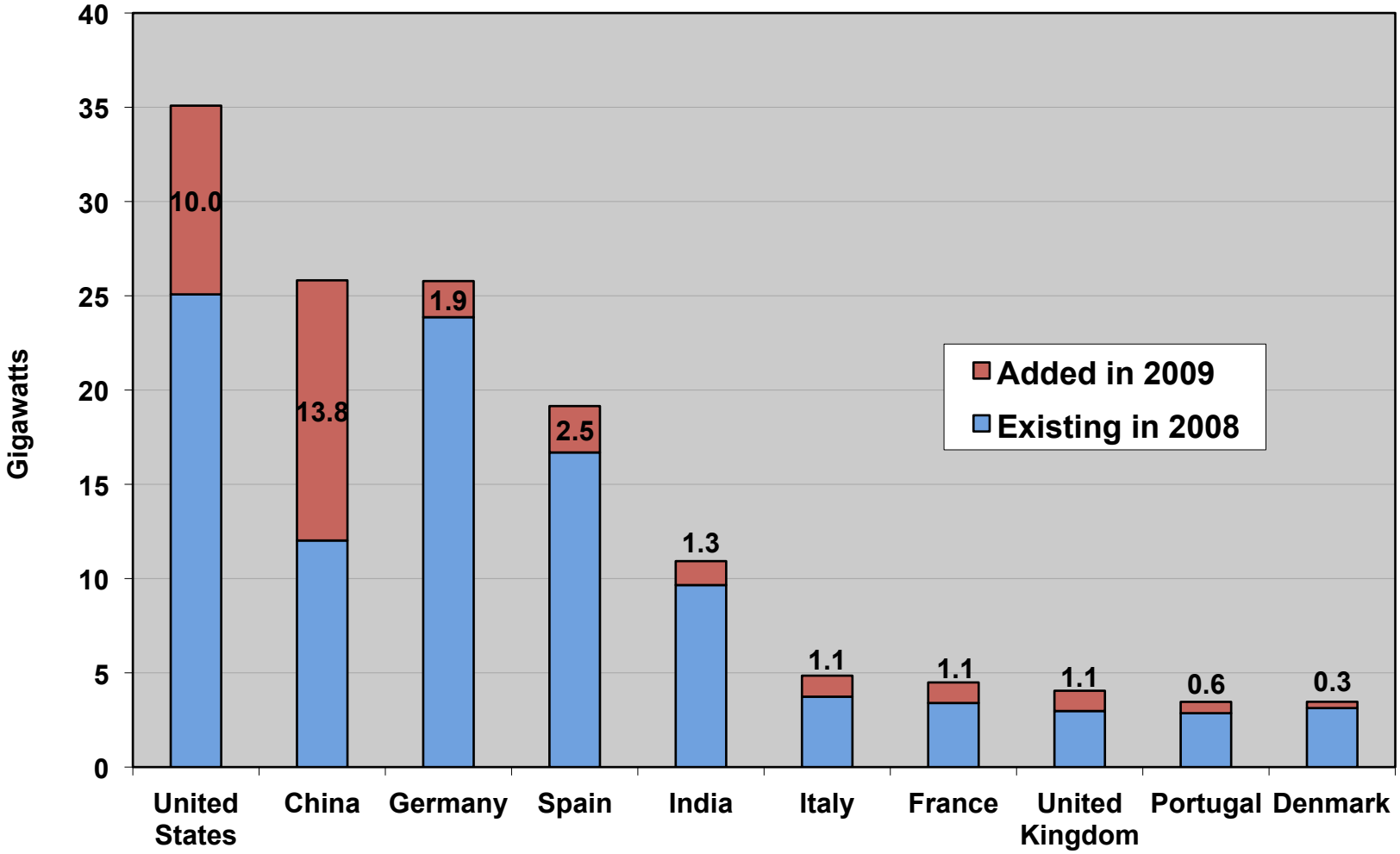


Figure 13. Market Shares of Top-Ten Wind Manufacturers, 2009

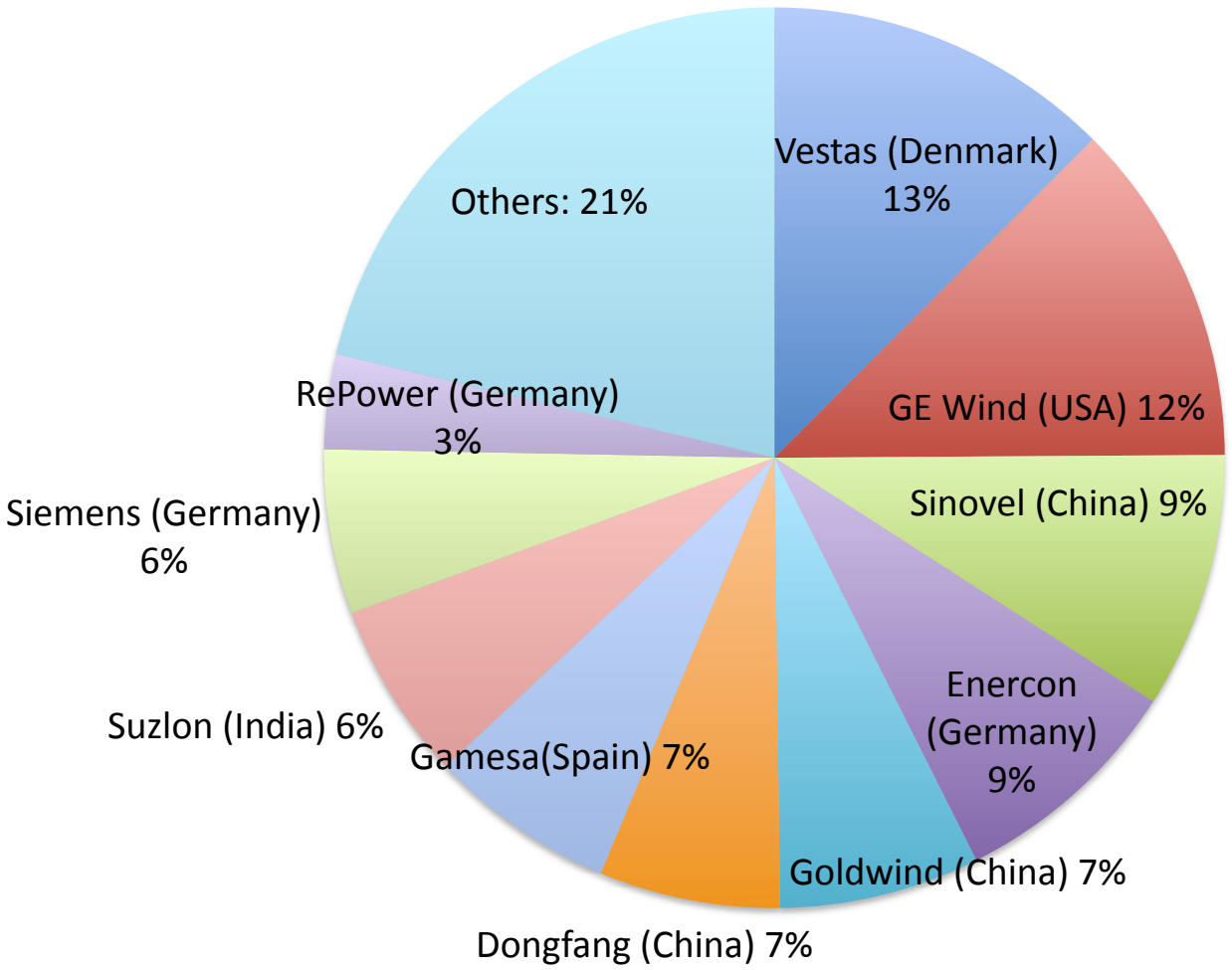


Figure 7. Solar PV, Existing World Capacity, 1995–2009

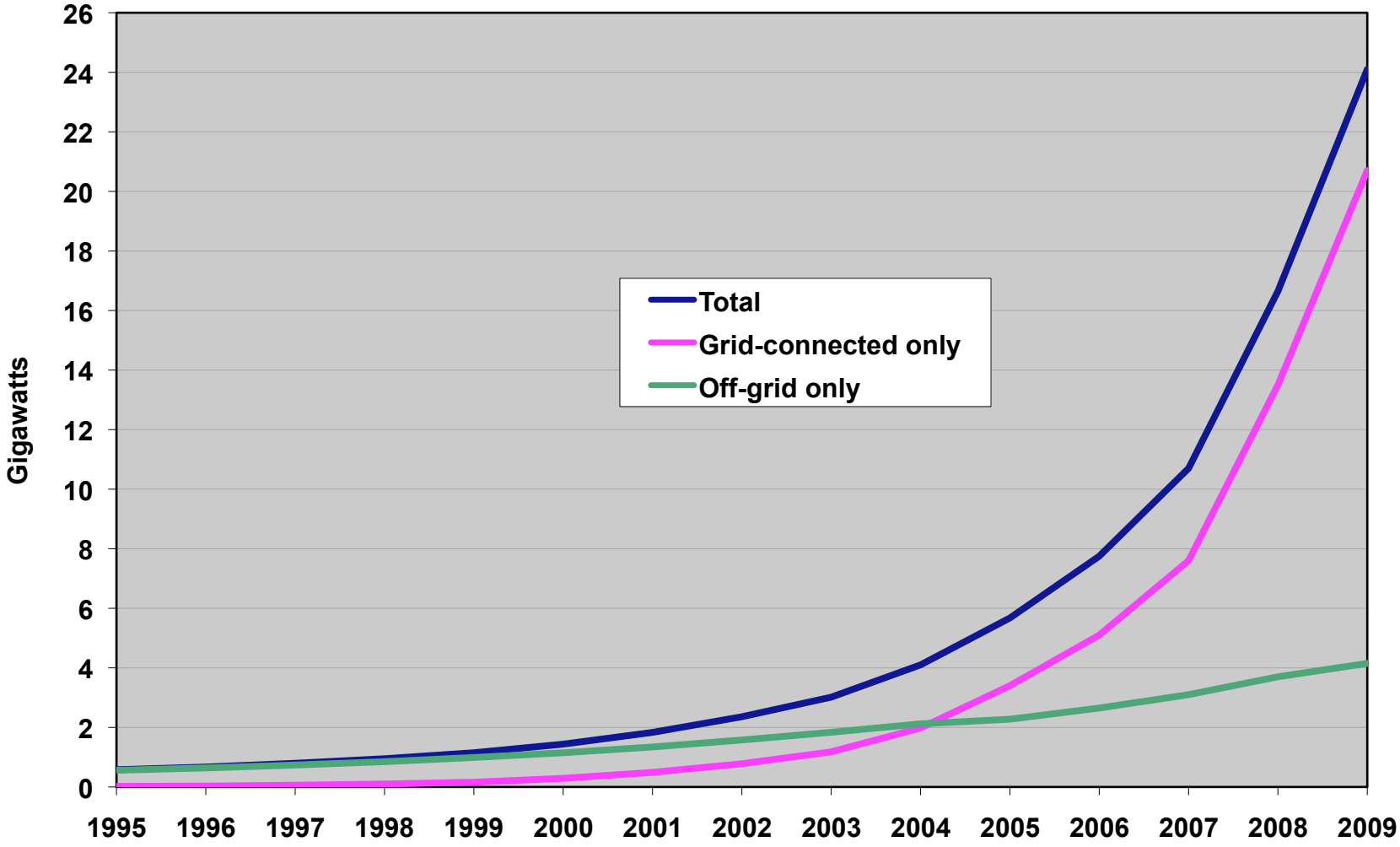
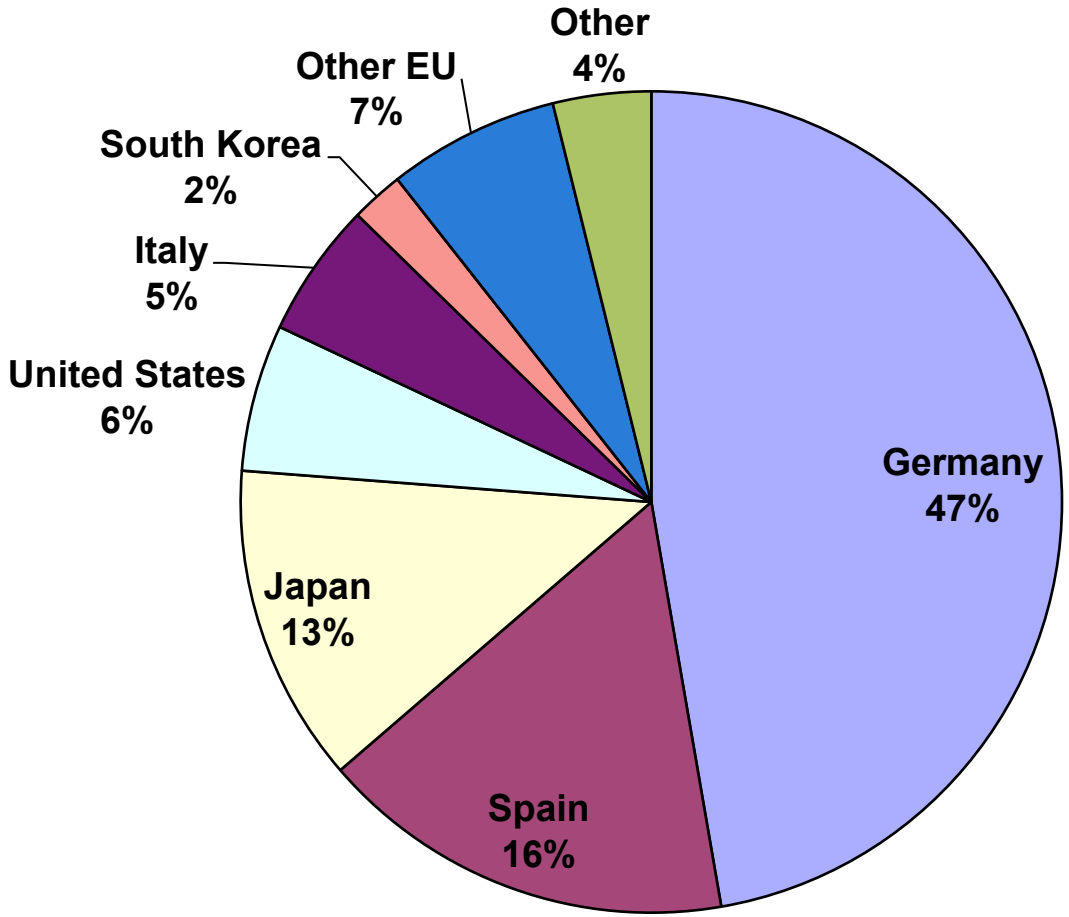
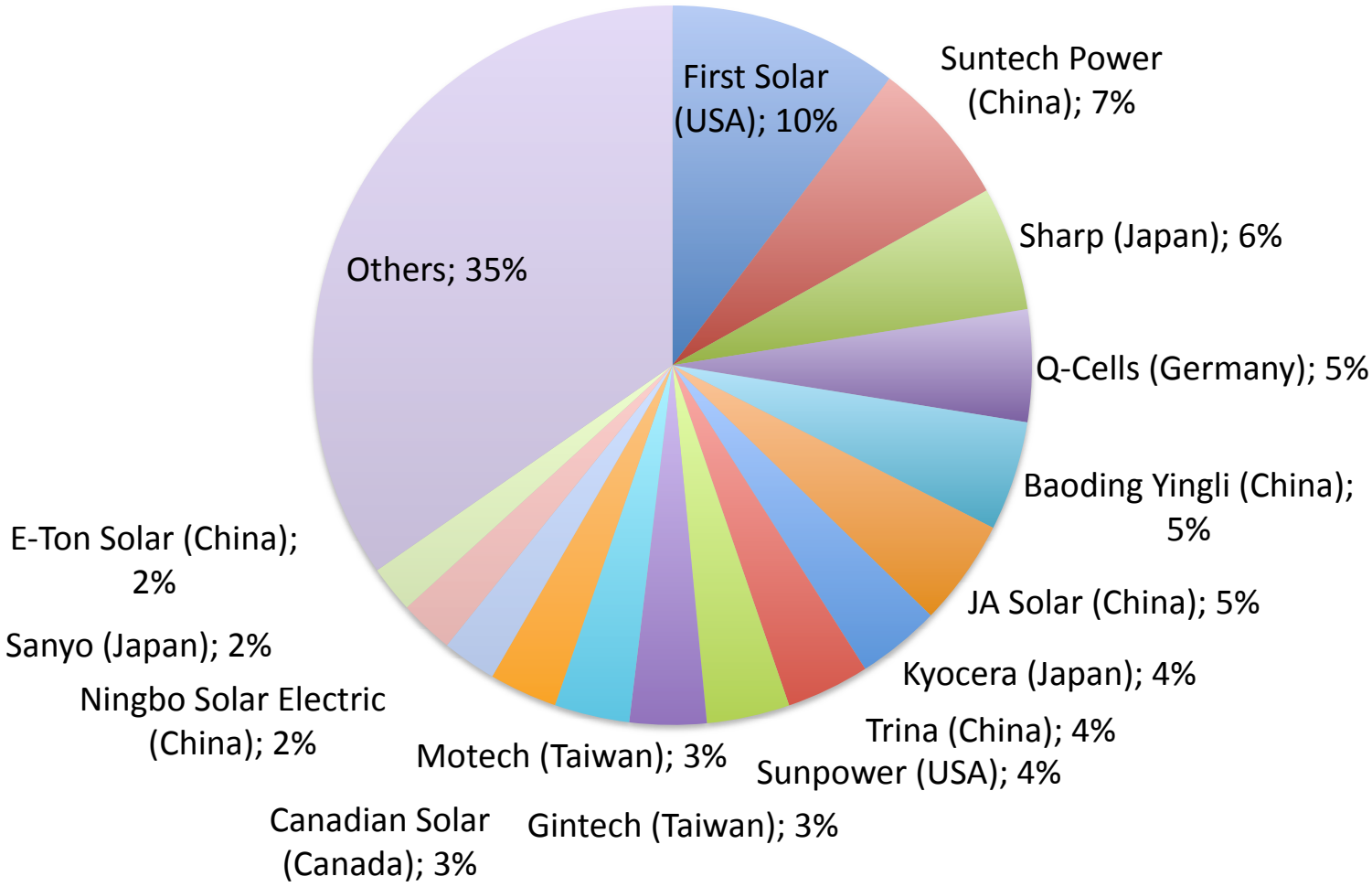


Figure 8. Solar PV Existing Capacity, Top Six Countries, 2009



Global Total = 21 GW

Figure 14. Market Shares of Top-Fifteen Solar PV Manufacturers, 2009



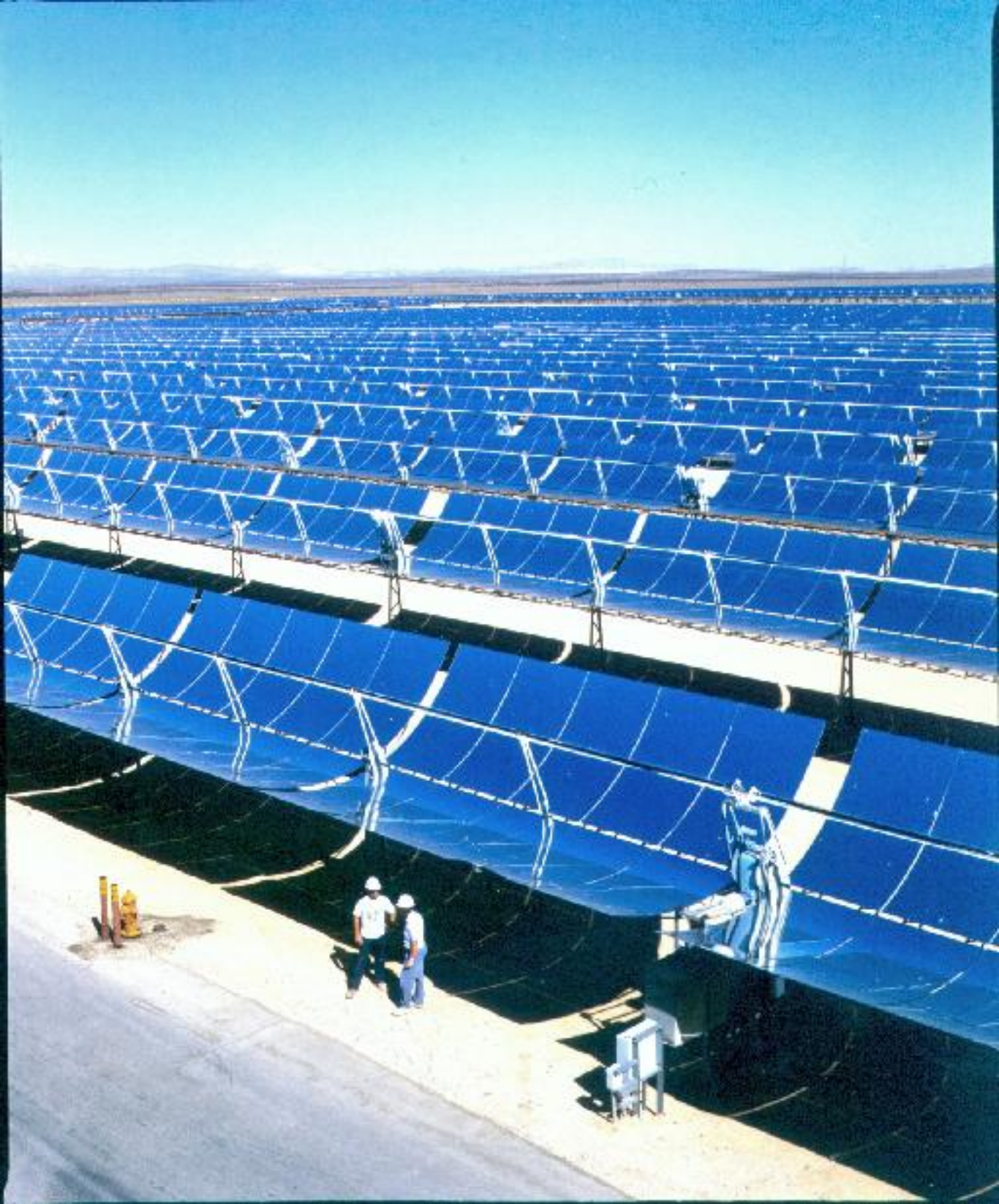
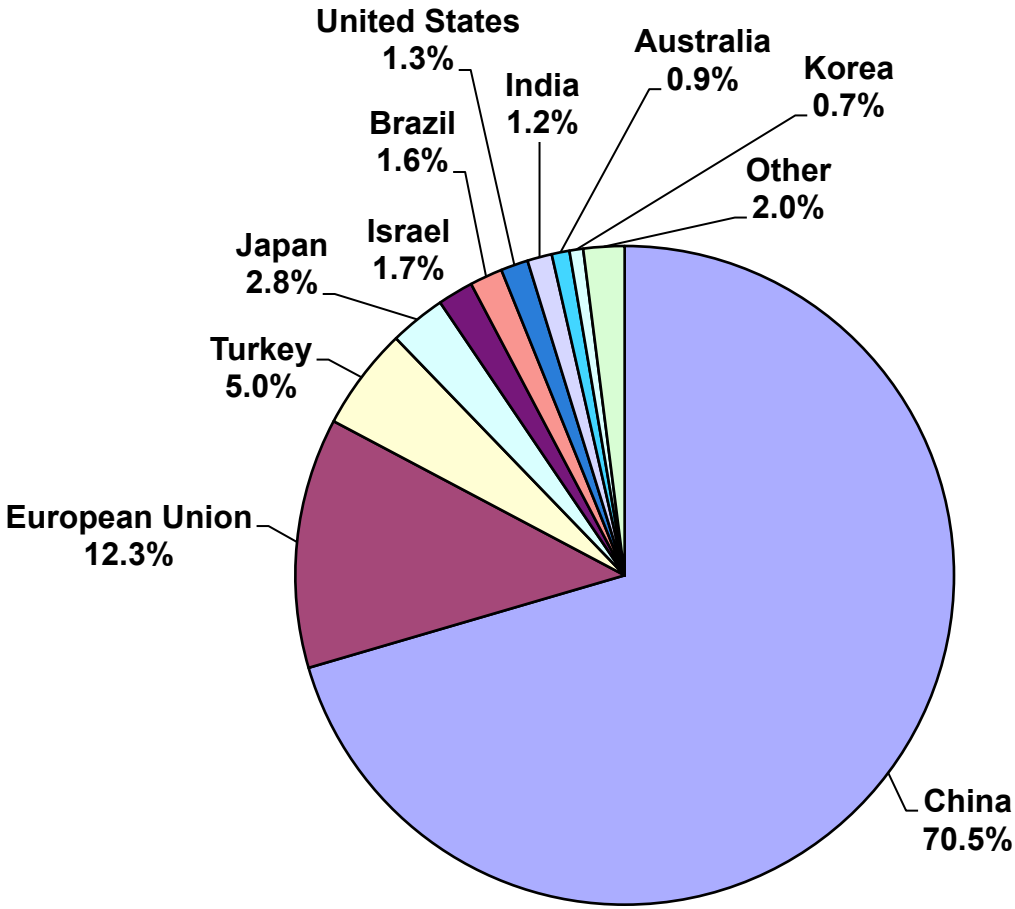
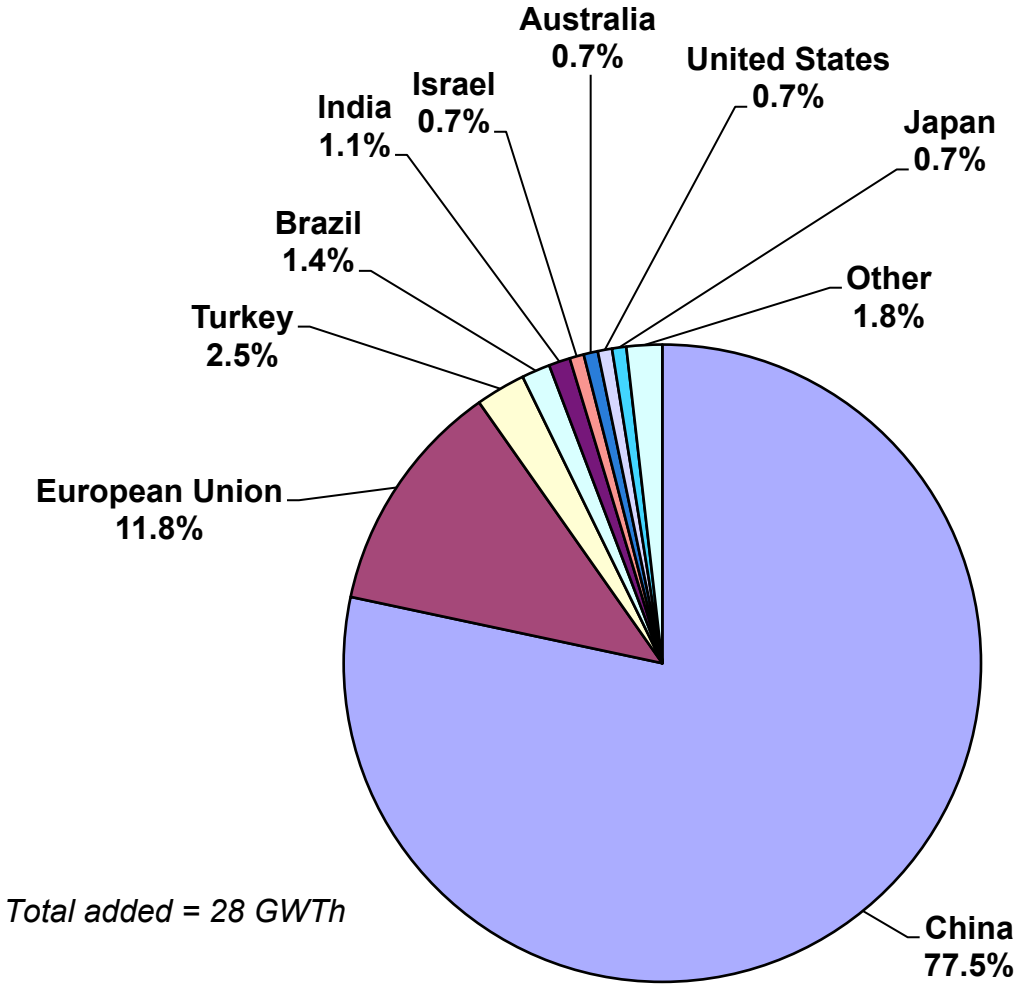


Figure 9. Solar Hot Water/Heating Existing Capacity, Top 10 Countries/Regions, 2008



Total = 149 GWTh

Figure 10. Solar Hot Water/Heating Capacity Added, Top 10 Countries/Regions, 2008




BIOFUELS
10
Renewable Energy Partners of New Mexico
ADVANTAGES OF BIOFUEL
B20 Biodies
E10 Unleaded
105
89
USE IN ANY DIESEL VEHICLE
USE IN FLEX FUEL VEHICLES ONL
USE IN ANY GASOLINE VEHICLE
B20
Premium Biodiesel
20% BIODIESEL
80% PETROLEUM DIESEL
E85
85% Ethanol
85% ETHANOL
15% UNLEADED GASOLINE
E10
Unleaded
10% ETHANOL
90% UNLEADED GASOLINE
BIMBO

Figure 11. Ethanol and Biodiesel Production, 2000–2009

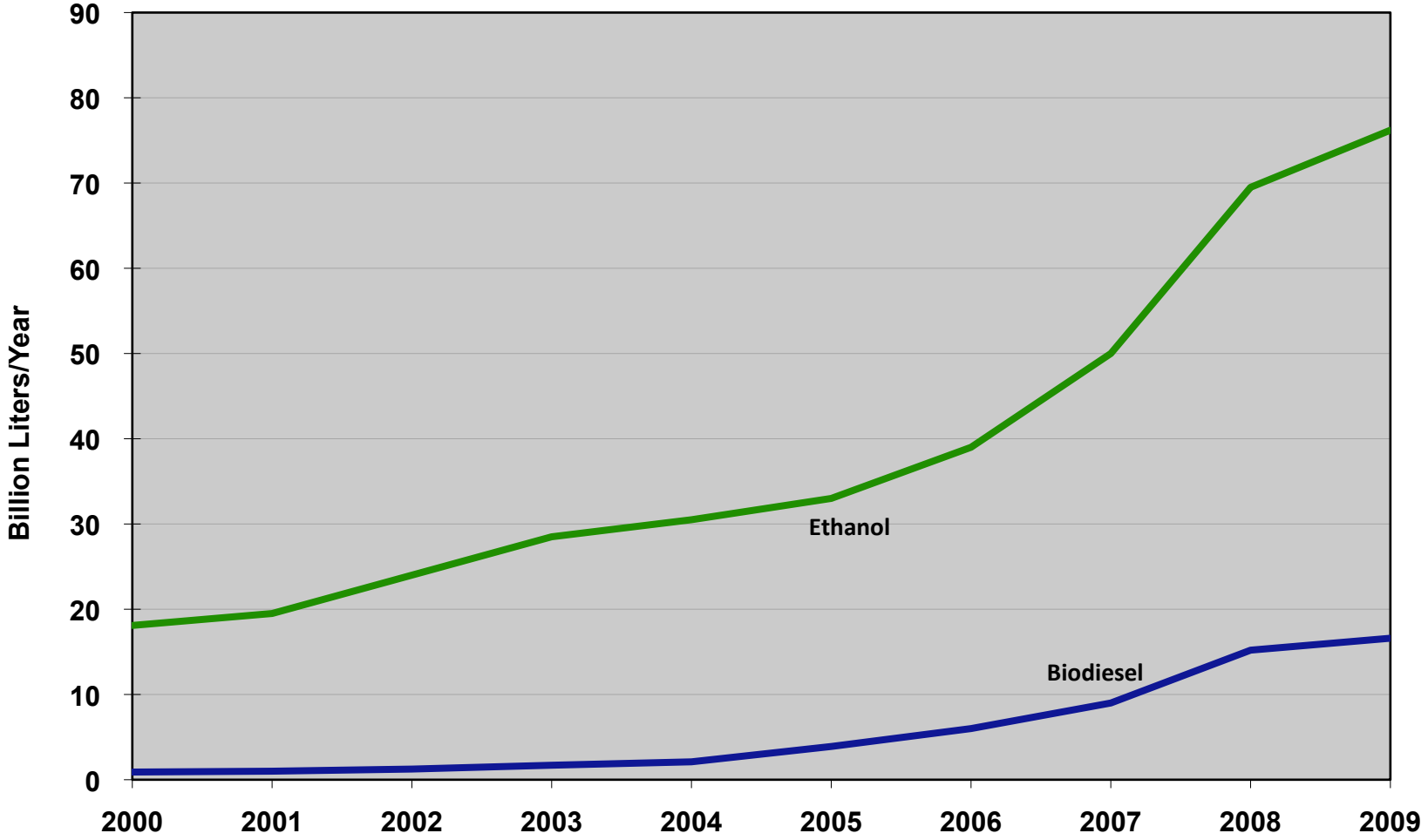
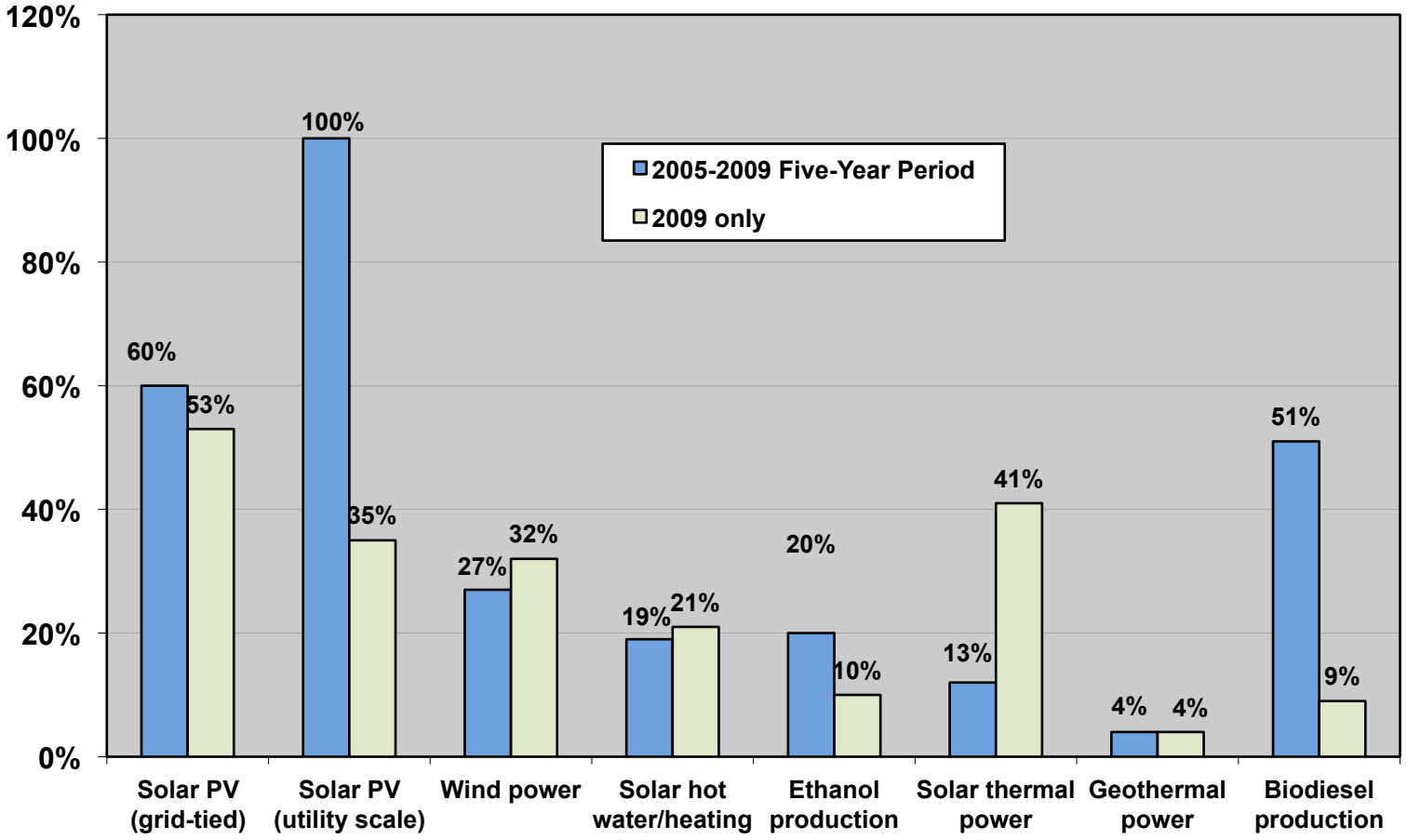


Figure 3. Average Annual Growth Rates of Renewable Energy Capacity, 2004–2009



Industry	Estimated jobs worldwide	Selected national estimates
Biofuels	> 1,500,000	
Wind power	400,000	Germany 87,000; United States 85,000; Spain 33,000, Denmark 22,000, India 10,000
Solar hot water	300,000	China 250,000
Solar PV	170,000	Germany 80,000, Spain 26,000, United States 7,000
Biomass power	---	Germany 110,000, United States 66,000, Spain 5,000
Hydropower	---	Europe 20,000, United States 8,000, Spain 7,000
Geothermal	---	Germany 9,000, United States 9,000
Solar thermal power	2,000	Spain 1,000, United States 1,000
Total	> 3,000,000	

Policy Landscape

- 73 countries now have policy targets
- 63 countries with policies to promote renewable power generation
- 45 countries and 18 states/provinces/territories with feed-in tariffs
- 49 countries, states, and provinces with renewable portfolio standards
- 55 countries, states, and provinces with biofuels blending mandates
- 5 million households and businesses worldwide voluntarily purchase green power.

Table 2. Renewable Energy Promotion Policies

Country	Feed-in tariff	Renewable portfolio standard	Capital subsidies, grants, or rebates	Investment or other tax credits	Sales tax, energy tax, excise tax, or VAT reduction	Tradable renewable energy certificates	Energy production payments or tax credits	Net metering	Public investment, loans, or financing	Public competitive bidding
Developed and transition countries										
Australia		✓	✓			✓			✓	
Austria	✓		✓	✓		✓			✓	
Belgium		✓	✓		✓	✓		✓		
Canada	(*)	(*)	✓	✓	✓			(*)	✓	(*)
Croatia	✓			✓					✓	
Cyprus	✓		✓							
Czech Republic	✓		✓	✓	✓	✓		✓		
Denmark	✓				✓	✓		✓	✓	✓
Estonia	✓				✓					
Finland			✓		✓	✓	✓			
France	✓		✓	✓	✓	✓			✓	✓
Germany	✓		✓	✓	✓				✓	
Greece	✓		✓	✓						
Hungary	✓				✓	✓			✓	
Ireland	✓		✓	✓		✓				✓
Italy	✓	✓	✓	✓		✓		✓		
Israel	✓									
Japan	(*)	✓	✓			✓		✓	✓	
Korea	✓		✓	✓	✓				✓	
Latvia	✓								✓	✓
Lithuania	✓		✓	✓					✓	
Luxembourg	✓		✓	✓						
Malta	✓				✓					
Netherlands	✓		✓	✓		✓	✓			
New Zealand			✓						✓	
Norway			✓	✓		✓				✓
Poland		✓	✓		✓				✓	✓
Portugal	✓		✓	✓	✓					
Romania					✓					
Russia			✓			✓				
Slovak Republic	✓			✓					✓	
Slovenia	✓								✓	
Spain	✓		✓	✓					✓	
Sweden		✓	✓	✓	✓	✓	✓			
Switzerland	✓									
United Kingdom		✓	✓		✓	✓				
United States	(*)	(*)	✓	✓	(*)	(*)	✓	(*)	(*)	(*)

Table R10. Cumulative Number of Countries/States/Provinces Enacting Feed-in Policies

Year	Cumulative Number	Countries/States/Provinces Added That Year
1978	1	United States
1990	2	Germany
1991	3	Switzerland
1992	4	Italy
1993	6	Denmark, India
1994	8	Spain, Greece
1997	9	Sri Lanka
1998	10	Sweden
1999	13	Portugal, Norway, Slovenia
2000	13	—
2001	15	France, Latvia
2002	21	Algeria, Austria, Brazil, Czech Republic, Indonesia, Lithuania
2003	28	Cyprus, Estonia, Hungary, South Korea, Slovak Republic, Maharashtra (India)
2004	33	Israel, Nicaragua, Prince Edward Island (Canada), Andhra Pradesh and Madhya Pradesh (India)
2005	40	Karnataka, Uttaranchal, and Uttar Pradesh (India); China, Turkey, Ecuador, Ireland
2006	43	Ontario (Canada), Argentina, Thailand
2007	49	South Australia (Australia), Albania, Bulgaria, Croatia, Macedonia, Uganda
2008	61	Queensland (Australia); California (USA); Gujarat, Haryana, Punjab, Rajasthan, Tamil Nadu, and West Bengal (India); Kenya, the Philippines, Poland, Ukraine
2009 (early)	63	Australian Capital Territory (Australia); South Africa

Table R11. Cumulative Number of Countries/States/Provinces Enacting RPS Policies

Year	Cumulative Number	Countries/States/Provinces Added That Year
1983	1	Iowa (USA)
1994	2	Minnesota (USA)
1996	3	Arizona (USA)
1997	6	Maine, Massachusetts, Nevada (USA)
1998	9	Connecticut, Pennsylvania, Wisconsin (USA)
1999	12	New Jersey, Texas (USA); Italy
2000	13	New Mexico (USA)
2001	15	Flanders (Belgium); Australia
2002	18	California (USA); Wallonia (Belgium); United Kingdom
2003	19	Japan; Sweden; Maharashtra (India)
2004	34	Colorado, Hawaii, Maryland, New York, Rhode Island (USA); Nova Scotia, Ontario, Prince Edward Island (Canada); Andhra Pradesh, Karnataka, Madhya Pradesh, Orissa (India); Poland
2005	38	District of Columbia, Delaware, Montana (USA); Gujarat (India)
2006	39	Washington State (USA)
2007	44	Illinois, New Hampshire, North Carolina, Oregon (USA); China
2008	49	Michigan, Missouri, Ohio (USA); Chile; India

Figure 15. EU Renewable Energy Targets—Share of Final Energy by 2020

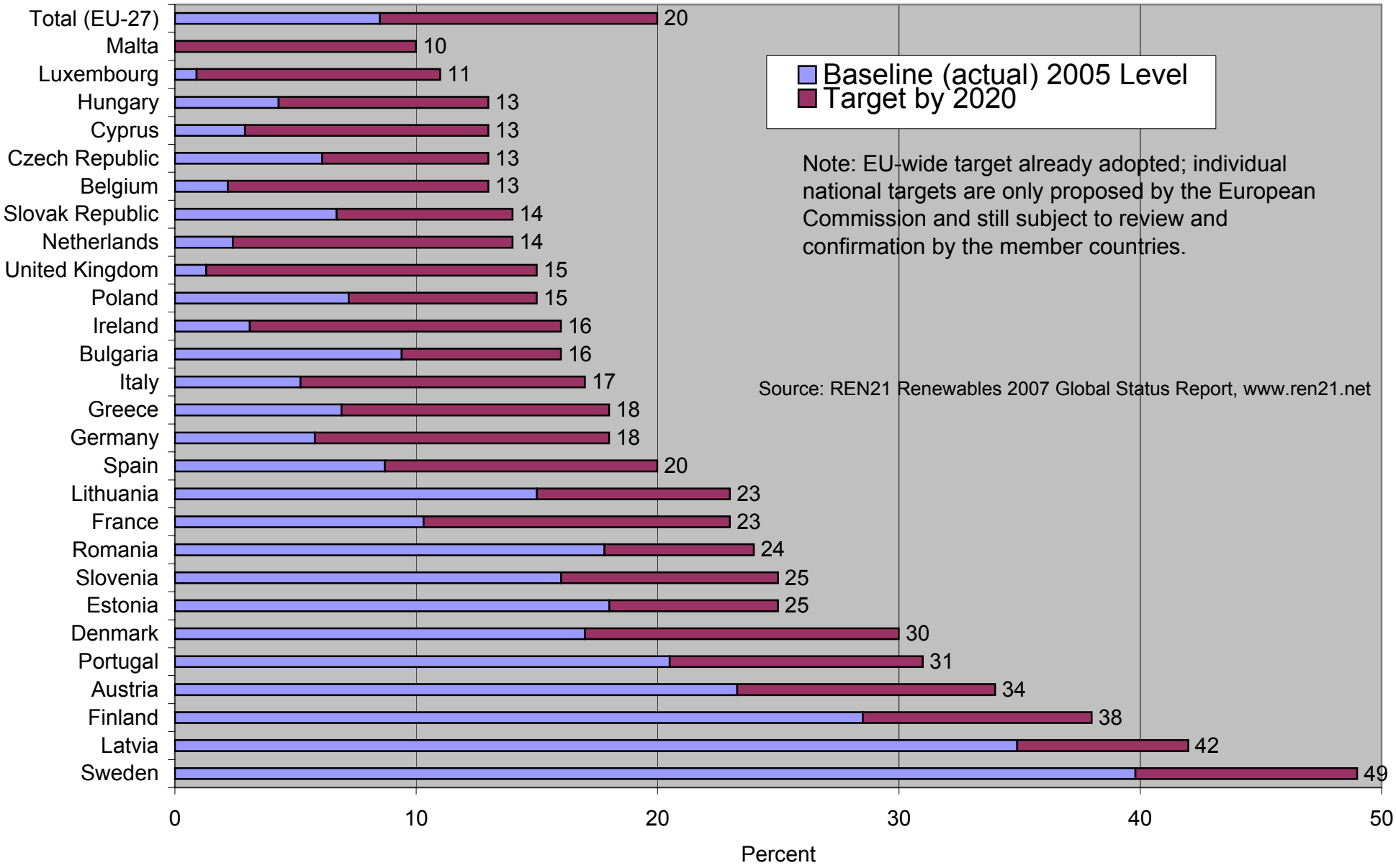


Table R8. Share of Electricity from Renewables, Existing in 2006 and Targets

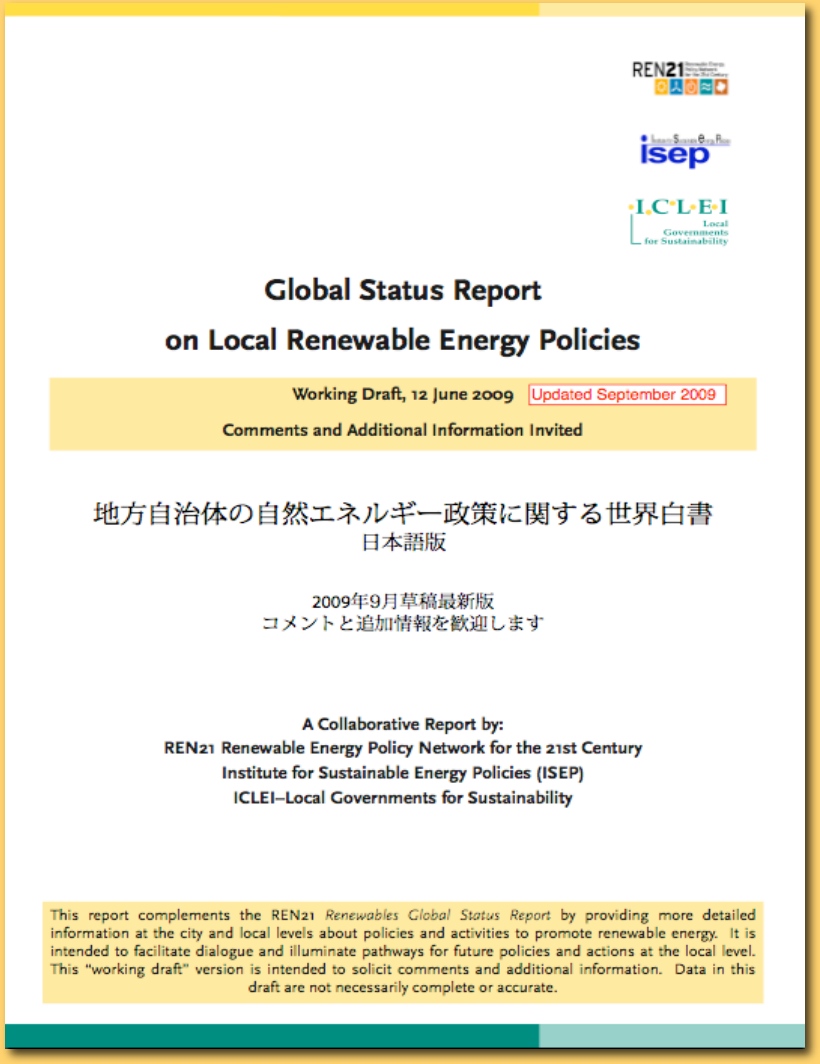
Country/region	Existing share (2006)	Future target
World	18%	—
EU-25	14%	21% by 2010
Selected EU Countries		
Austria	62%	78% by 2010
Belgium	2.8%	6.0% by 2010
Czech Republic	4.2%	8.0% by 2010
Denmark	26%	29% by 2010
Finland	29%	31.5% by 2010
France	10.9%	21% by 2010
Germany	11.5%	12.5% by 2010
Greece	13%	20.1% by 2010
Hungary	4.4%	3.6% by 2010
Ireland	10%	13.2% by 2010
Italy	16%	25% by 2010
Luxembourg	6.9%	5.7% by 2010
Netherlands	8.2%	9.0% by 2010
Poland	2.6%	7.5% by 2010
Portugal	32%	45% by 2010
Slovak Republic	14%	31% by 2010
Spain	19%	29.4% by 2010
Sweden	49%	60% by 2010
United Kingdom	4.1%	10% by 2010
Other Developed/OECD Countries		
Australia	7.9%	—
Canada	59%	—
Israel	—	5% by 2016
Japan*	0.4%	1.63% by 2014
Korea	1.0%	7% by 2010
Mexico	16%	—
New Zealand	65%	90% by 2025
Switzerland	52%	—
United States	9.2%	—
Developing Countries		
Argentina*	1.3%	8% by 2016
Brazil*	5%	—
China	17%	—
Egypt	15%	20% by 2020
India	4%	—
Malaysia	—	5% by 2005
Morocco	10%	20% by 2012
Nigeria	—	7% by 2025
Pakistan	—	10% by 2015
Thailand	7%	—

The Promise of Local Action for Renewable Energy

City and local governments can play a key role in encouraging renewable energy at the local level as:

- Decision-makers (legislative and taxing authority)
- Planning authorities
- Managers of municipal infrastructure (purchasing power)
- Role models for citizens and businesses
- Facilitators for private activity

The “energy systems of tomorrow” could enable moving towards 100% renewable energy – and many are now calling for this – with distributed generation, demand-side measures, embedded energy storage, smart grids, and electric vehicles. Local governments can be leaders in shepherding and managing these transitions.



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ICLEI
Local Governments for Sustainability

Global Status Report

on Local Renewable Energy Policies

Working Draft, 12 June 2009 Updated September 2009

Comments and Additional Information Invited

地方自治体の自然エネルギー政策に関する世界白書
日本語版

2009年9月草稿最新版
コメントと追加情報を歓迎します

A Collaborative Report by:
REN21 Renewable Energy Policy Network for the 21st Century
Institute for Sustainable Energy Policies (ISEP)
ICLEI–Local Governments for Sustainability

This report complements the REN21 *Renewables Global Status Report* by providing more detailed information at the city and local levels about policies and activities to promote renewable energy. It is intended to facilitate dialogue and illuminate pathways for future policies and actions at the local level. This "working draft" version is intended to solicit comments and additional information. Data in this draft are not necessarily complete or accurate.

Global Status Report on Local Renewable Energy Policies

（Working Draft: September 2009）

Lead Author: Eric Martinot

A Collaborative Report by REN21, ISEP and ICLEI

Table 2: Europe – Selected Local Renewable Energy Policies

	Target setting	Regulation based on legal responsibility and jurisdiction				Operation of muni infrastructure			Voluntary actions and government as role model				Info/ promo
		Urban	Building	Taxes	Other	Purch	Invest	Utility	Demo	Grants	Land	Other	
Barcelona	X	X	X				X					X	X
Berlin	X	X								X	X		X
Bologna	X	X	X										
Bristol	X	X			X	X			X				X
Copenhagen	X												
Cremona							X			X			
Edinburgh	X	X							X				
Frederikshavn	X	X		X								X	X
Freiburg	X					X			X		X		X
Gelsenkirchen		X							X			X	X
Göteborg	X	X							X				
Grenoble	X			X						X			
Hamburg	X	X					X		X			X	X
Languedoc reg		X								X		X	
Lausanne		X					X			X			
Leister	X												
Linz							X					X	
London	X	X	X			X						X	
Madrid	X	X			X	X							X
Malmö	X	X					X						
Milagro												X	
Münster	X				X								
Oslo	X	X					X			X		X	
Oxford	X	X								X			X
Paris	X	X											
Ponferrada			X			X				X			
Rhône-Alpes r.	X											X	
Rome	X						X			X			
Rovigo prov.	X	X					X			X			X
Samsø	X						X					X	
Seville	X												X
Stockholm	X	X				X	X					X	X
The Hague	X	X							X				
Växjö	X	X											X
Walloon region	X						X					X	X
Woking Boro.	X	X	X		X	X			X			X	X
Zaragoza	X	X	X									X	X

Table 5: Japan – Selected Local Renewable Energy Policies

	Target setting	Regulation based on legal responsibility and jurisdiction				Operation of muni infrastructure			Voluntary actions and government as role model				Info/ promo
		Urban	Building	Taxes	Other	Purch	Invest	Utility	Demo	Grants	Land	Other	
Chiba	X									X			
Fukuoka	X												
Hamamatsu	X									X			
Hiroshima	X									X			
Hokuto		X					X			X			X
Iida	X	X				X				X	X	X	X
Kanagawa pr	X	X				X	X			X		X	X
Kawasaki	X	X				X	X			X			X
Kitakyushu	X	X								X			X
Kobe	X	X								X			
Kyotango		X								X			
Kyoto	X	X							X	X		X	X
Matsuyama							X			X			
Nagoya	X	X											
Niigata	X	X											
Osaka	X												
Saitama	X	X											
Sakai	X	X								X			
Sapporo	X	X				X			X	X			X
Sendai	X												
Shizuoka	X												
Tokyo	X	X	X	X	X				X	X	X	X	X
Tsuru		X				X				X		X	
Yokohama	X	X			X		X			X	X	X	X

(Slide 1 of 5) Framework for Local Renewable Energy Policies/Activities

Policy/Activity Category	Descriptions of Policies/Activities by Sub-Category
1. Target setting	(a) CO2 reduction targets
	(b) Future shares/amounts of renewable electricity or energy for all consumers in city
	(c) Future shares/amounts of renewable electricity or energy for government operations and/or buildings
	(d) Future shares or absolute numbers of buildings or homes with renewable energy installations
	(e) Future shares/amounts of biofuels for the government vehicle fleet and/or for public transport
	(f) Other types of targets, for example to become fossil-fuel free or “carbon neutral”

Of the 180 cities and local governments in the report, at least 140 have some type of future target for renewable energy and/or CO2.

Targets for Share of Renewable Energy -- Examples

- Ballarat, Australia: 10% of total energy by 2016
- Beijing, China: 4% of electric power capacity by 2010 and 6% of heating
- Calgary AB, Canada: 30% of total energy by 2036
- Cape Town, South Africa: 10% of total energy by 2020
- Grenoble, France: 21% of total energy (currently 8%)
- Lüchow-Dannenberg district, Germany: 100% of total energy by 2010-2015
- Madrid, Spain: 20% reduction in fossil-fuel use by 2020
- Münster, Germany: 20% of total energy by 2020
- Rajkot, India: 10% reduction in conventional energy by 2013
- Samsø, Denmark: 100% of total energy
- Shanghai, China: 5% of energy (capacity) by 2010
- Stockholm, Sweden: 80% of district heating from renewable sources
- Tokyo, Japan: 20% of total energy by 2020
- Växjö, Sweden: 100% of total energy (fossil-fuel free)

(Slide 2 of 5) Framework for Local Renewable Energy Policies/Activities

Policy/Activity Category	Descriptions of Policies/Activities by Sub-Category
2. Regulation based on legal responsibilities and jurisdiction	(a) Urban planning and zoning that encourages and integrates the local generation, distribution and use of renewable sources of power in the local jurisdiction--including planning and zoning for public transportation and electric vehicle infrastructure.
	(b) Building codes and/or permitting that applies to, or incorporates renewable energy in some manner. Examples: mandates for solar hot water and solar PV installations, zero-net-energy homes, shading legislation, and mandated design review/scoping of opportunities and potentials for renewable energy.
	(c) Tax credits and exemptions within tax systems: for example, sales, property and fuel taxes, permitting fees, and carbon taxes.
	(d) Other regulation, including municipal departments mandated to promote or plan for renewable energy, mandates for biofuels use in vehicles or biofuels blending, and mandatory carbon cap-and-trade.

Of the 180 cities and local governments in the report, at least half have some type of urban planning that incorporates renewable energy, and at least 35 have some type of building code or permitting policy

Building Codes and Permitting -- Examples

- Barcelona, Spain: Mandates 60% of hot water heating energy from solar in all new buildings and major renovations; was subsequently copied by 70 other municipalities throughout Spain
- Lianyangang, China: Requires solar hot water in all new residential buildings up to 12 stories, and in new construction and renovation of hotels and commercial buildings
- Rajkot, India: Requires new residential buildings larger than 150 m2 and hospitals and other public buildings to install solar hot water
- Rio de Janeiro: Requires all public buildings to use solar hot water for 40% of heating energy
- San Francisco: Requires all new buildings over 100,000 ft2 to supply 5% of building energy use from on-site solar
- Tokyo: Requires property developers to assess and consider possibilities for solar hot water and other renewables and report assessments to owners

(Slide 3 of 5) Framework for Local Renewable Energy Policies/Activities

Policy/Activity Category	Descriptions of Policies/Activities by Sub-Category
3. Operation of municipal infrastructure	(a) Local government purchasing (and joint-purchasing with other municipalities or with private sector) to integrate renewable energy into government operations. Includes renewable electricity, biofuels, and bulk purchasing for market transformation programs.
	(b) Local government investment in renewable energy for government buildings, schools, vehicle fleets, and public transport.
	(c) Public utility regulation, including tariff regulation, renewable energy targets, feed-in tariffs, interconnection standards, net metering, and portfolio standards; also designates private utility policies of these types.

Of the 180 cities and local governments in the report, at least half have some type of policy related to municipal infrastructure and operations

Electric Utility Policies -- Examples

- Austin TX, USA: Renewable portfolio standard 30% by 2020
- Boulder CO, USA: Carbon tax on fossil-fuel electricity purchases
- Gainesville FL, USA: Feed-in tariff for solar PV (32 cents/kWh for 20 years)
- Mexico City: Net metering for solar PV
- Minneapolis MN, USA: Renewable portfolio standard 30% by 2020 (for Xcel Energy)
- New York City: Net metering up to 2 MW capacity
- Oakville ON, Canada: Local utility voluntary green power sales
- Sacramento CA, USA: Feed-in tariff for eligible generation starting January 2010 (by SMUD)

(Slide 4 of 5) Framework for Local Renewable Energy Policies/Activities

Policy/Activity Category	Descriptions of Policies/Activities by Sub-Category
4. Voluntary actions and government serving as a role model	(a) Demonstration projects, including participation in national pilot and demonstration projects. Often done with private sector.
	(b) Grants, subsidies, and loans for investments in renewable energy by homeowners or businesses
	(c) Using local government land/property for renewable energy installations (leasing/selling/permitting). Can also include deals that require developer promises for renewables and efficiency.

Of the 180 cities and local governments in the report, at least 50 have subsidies, grants, or loans for end-users to install renewable energy

Subsidies, Grants, and Loans -- Examples

- Adelaide, Australia: Subsidy for solar PV, A$1000/watt for > 1kW
- Alice Springs, Australia Subsidies for solar hot water (35%)
- Aspen CO, USA: Subsidies for solar PV ($1500 for > 2kW)
- Berkeley CA, USA: Loans to households for solar PV, repaid through property tax bills (up to $37,500 per installation)
- Berlin, Germany: Subsidies for solar PV (40%) and solar hot water (30%) on apartment buildings
- Boulder CO, USA: Small loan program ($3000-5000 loans)
- Christchurch, New Zealand: Lower permit costs for solar hot water
- Kawasaki, Japan: Subsidies for solar PV for households (JPY 70,000/kW up to 3.5 kW)
- Porto Alegre, Brazil: Grants for solar hot water in buildings
- Rome, Italy: Subsidies for solar hot water (to 30%), solar PV (to 60%)
- Toronto ON, Canada: Sustainable energy fund low interest loans

(Slide 5 of 5) Framework for Local Renewable Energy Policies/Activities

Policy/Activity Category	Descriptions of Policies/Activities by Sub-Category
5.Information promotion, and raising awareness	Includes public media campaigns and programs; recognition activities and awards; organization of stakeholders; forums and working groups; training programs; enabling access to finance by local stakeholders; enabling stakeholder-owned projects; removing barriers to community participation; energy audits and GIS databases; analysis of renewable energy potentials; information centers; and initiation and support for demonstration projects.

Virtually all cities have some type of activity in this category

Global Scenarios for Renewable Energy

- International Energy Agency “Blue Map” scenario (2008) shows 50% of electricity from renewables by 2050.
- Greenpeace advanced “revolution” scenario (2008): renewables 77% of electricity by 2050.
- Global Wind Energy Council (GWEC) advanced scenario: wind power provides 20-25% of global electricity by 2030, using growth rates much less than current growth.
- Distributed generation (DG), including solar PV, biomass and biogas power, small wind: most scenarios do not envision a large role, but one group of European experts estimated 30% of total electricity in the EU from DG by 2020.
- Distributed solar PV provides 30% of global electricity beyond 2040? Some analysts have constructed scenarios based on radical cost reduction in solar PV technology.

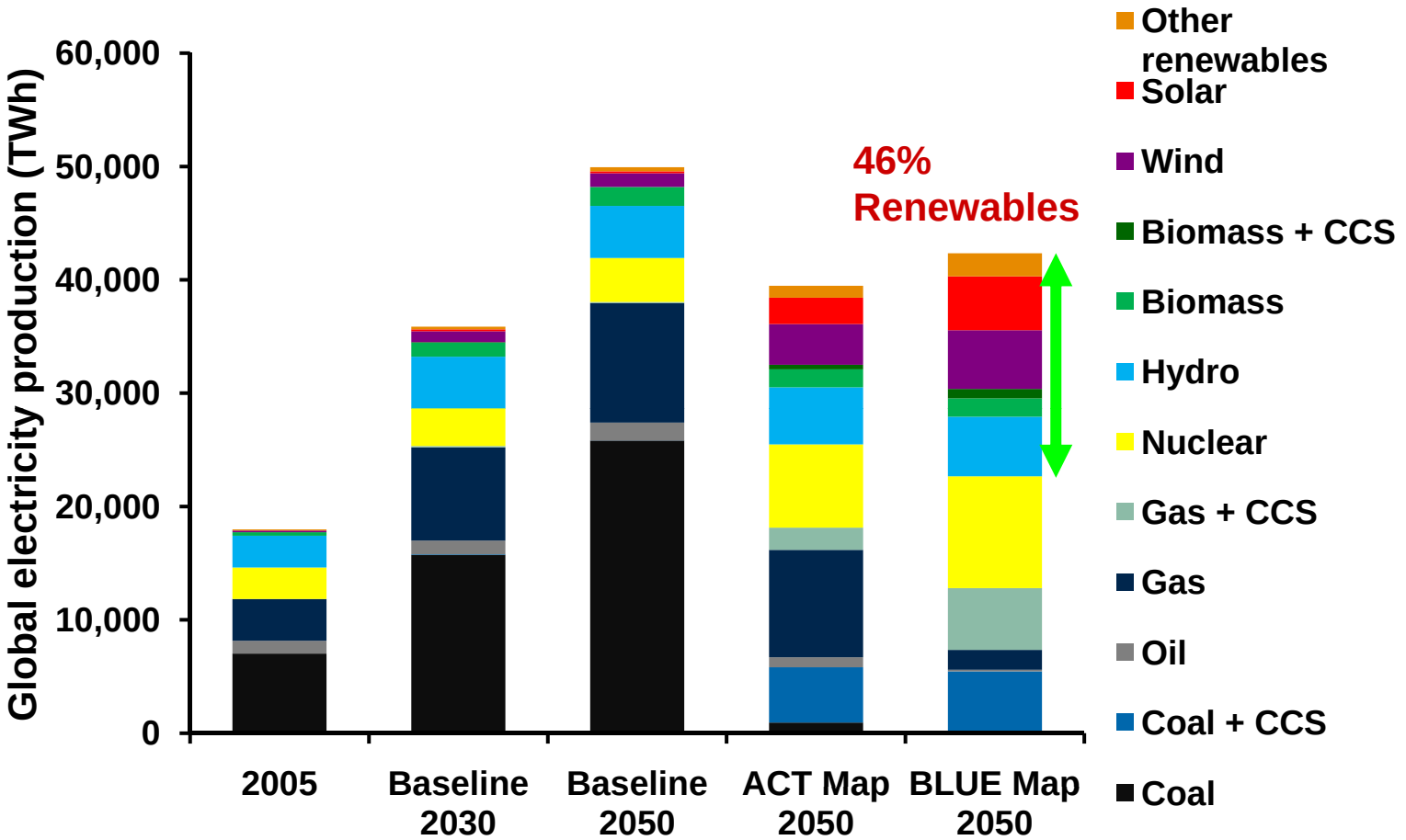
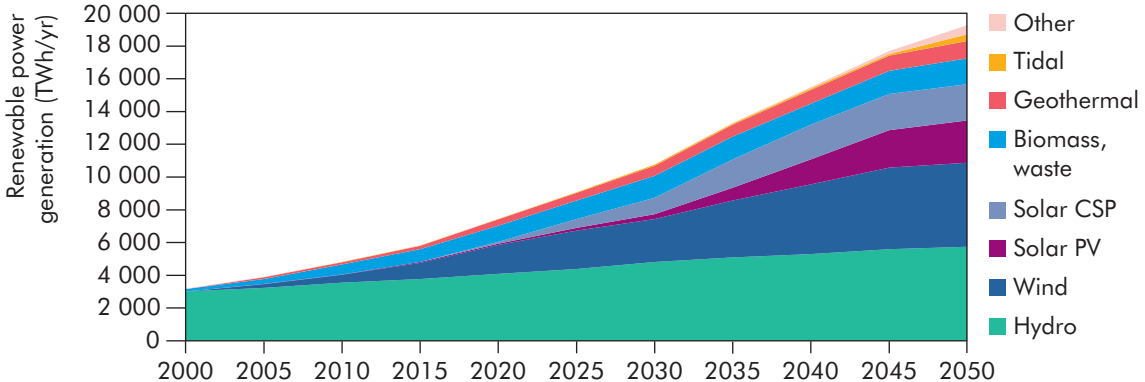

Global electricity production (TWh)
60,000
50,000
40,000
30,000
20,000
10,000
0
2005
Baseline 2030
Baseline 2050
ACT Map 2050
BLUE Map 2050
46% Renewables
Other renewables
Solar
Wind
Biomass + CCS
Biomass
Hydro
Nuclear
Gas + CCS
Gas
Oil
Coal + CCS
Coal

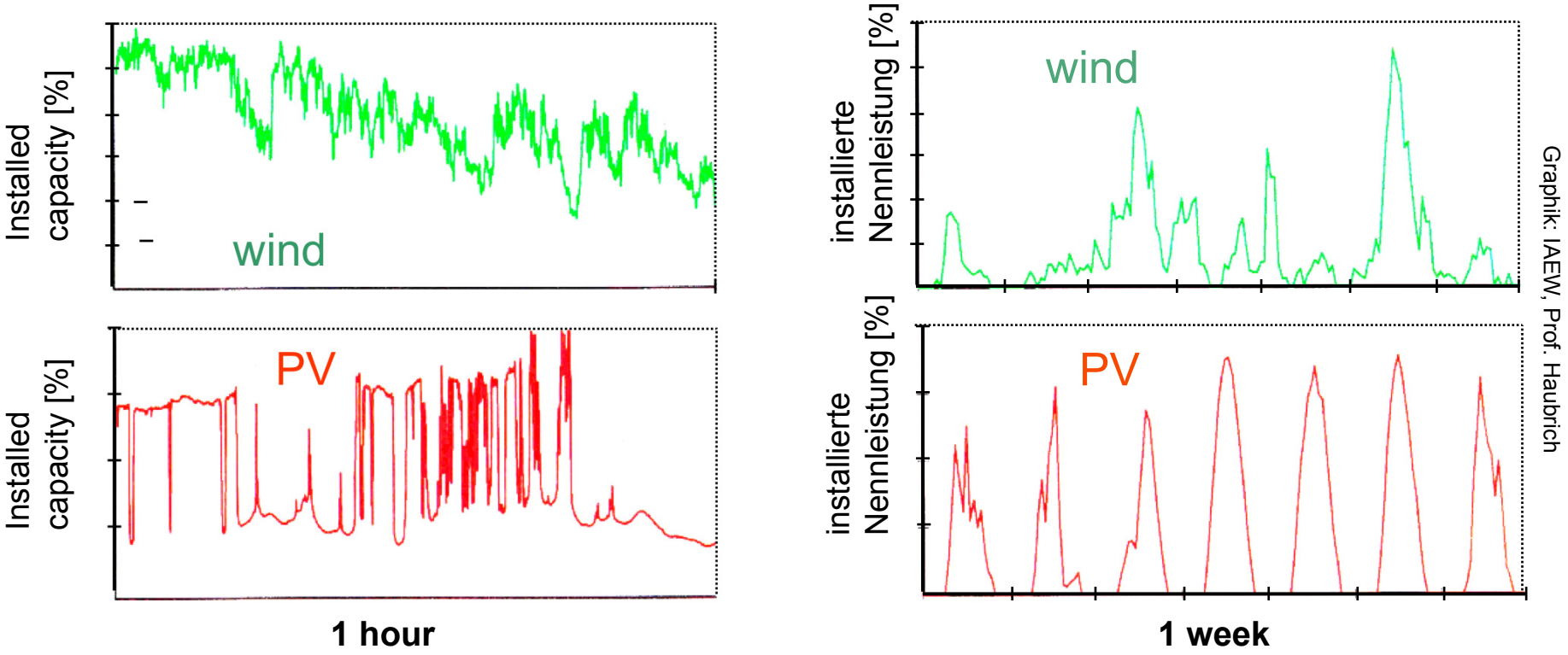
Figure 2.18 ▶ Growth of renewable power generation in the BLUE Map scenario, 2000-2050



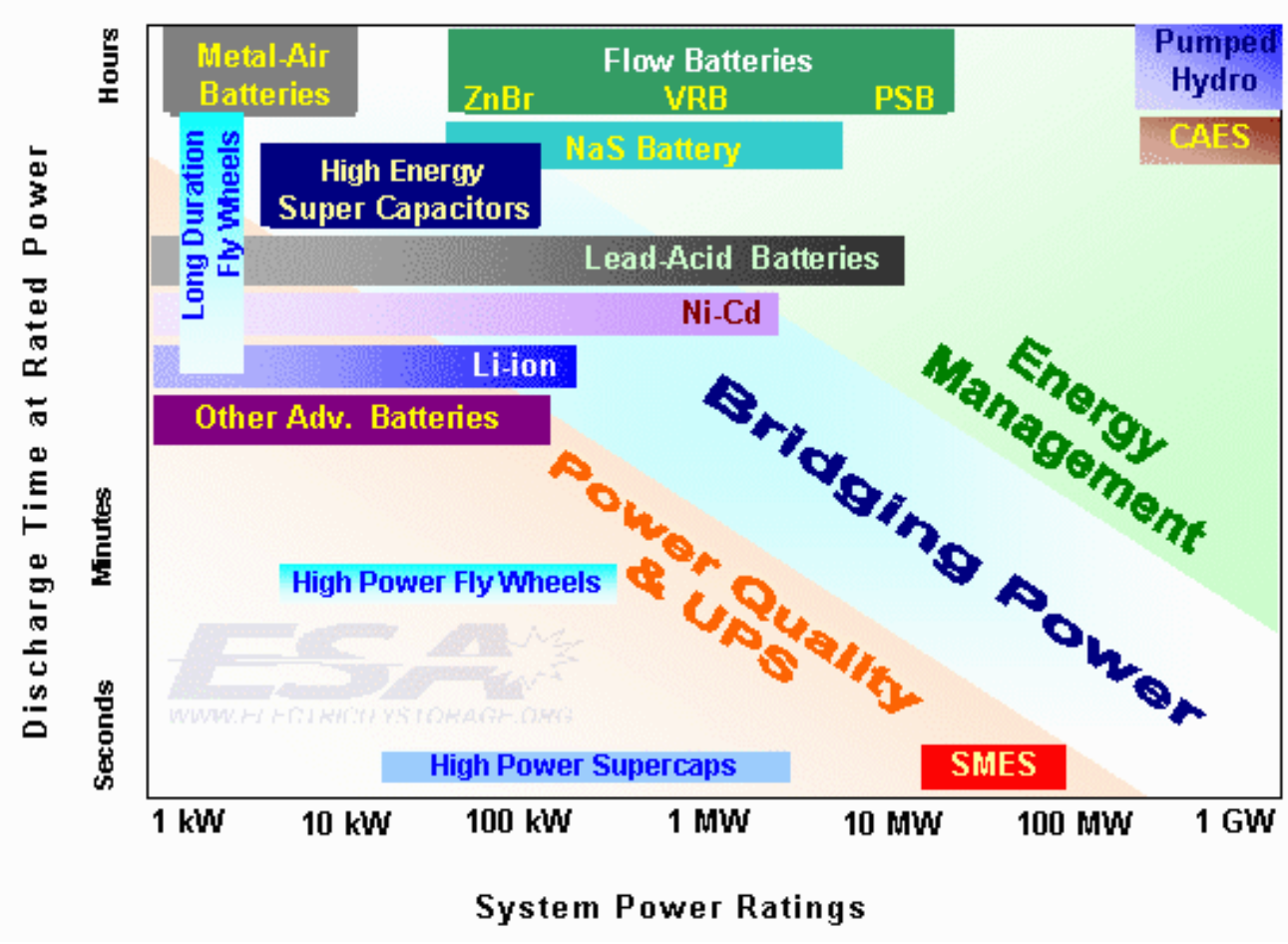
Key point

There is a very strong growth of different renewables options in BLUE Map.

Fluctuating power generation from solar and wind

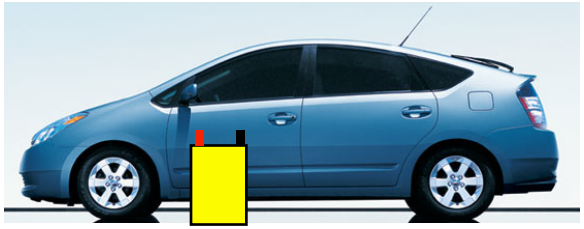


Technology Capacity Ratings

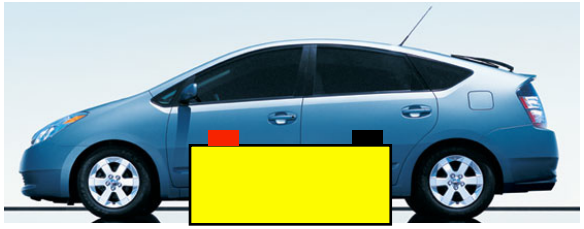


» These ESA charts are being updated …

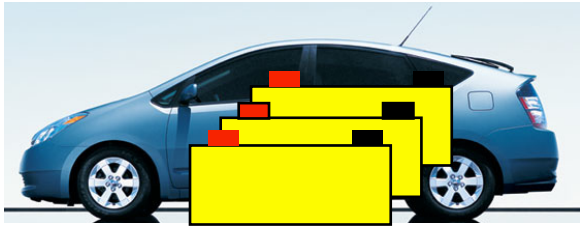
Electrification concepts for passenger cars



Hybrid electric vehicle (HEV)
Storage capacity approx. 1 kWh, charging only during driving, fuel reduction max. 20%



Plug-in Hybrid electric vehicle (PHEV)
Storage capacity 5 – 10 kWh, charging from the grid, 30 to 70 km electrical driving range, full driving range with conventional engine or fuel cell, driving with empty battery possible



Electric vehicle (EV)
Storage capacity 15 – 40 kWh, charging from the grid, 100 to 300 km electrical driving range

Renewable Energy for Japan – Development and Research Priorities

1. Cities and buildings (issues: local planning, building standards, industry development, training/certification, distributed generation)
   - Rooftop solar hot water and heating
   - Rooftop solar power
   - Passive solar architecture (combined with energy efficient buildings)
   - Geothermal heat pumps
   - Small-scale biomass combined-heat-and-power

2. Bulk power generation (issues: grid stability, transmission access, geographic balance and resource variability)
   - Large-scale wind farms
   - Grid-based battery storage (i.e., Vanadium redox flow batteries)
   - Pumped hydropower storage

3. Transportation (issues: integration of electric power and transportation infrastructure, integrated planning)
   - Electric vehicles charged with renewable energy through “smart grids” and vehicle-to-grid (V2G) technologies

Motivations for Renewables

- Energy security / energy autonomy
- Local economic development
- Industrial competitiveness
- Climate change
- Other environmental impacts (i.e., urban air pollution, acid rain, oil spills, habitat destruction from oil and gas drilling, land degradation from coal mining, waterway thermal pollution)