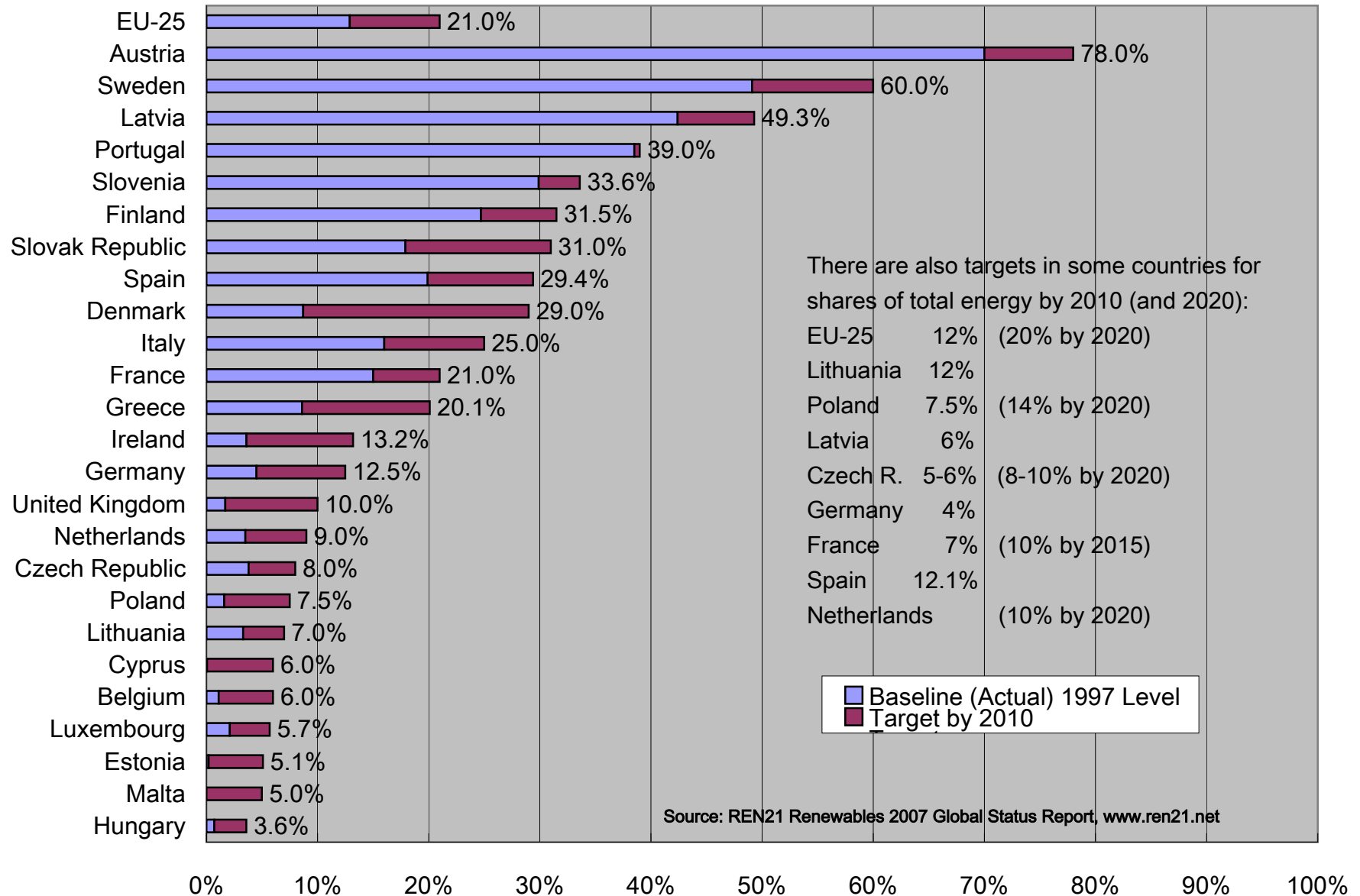


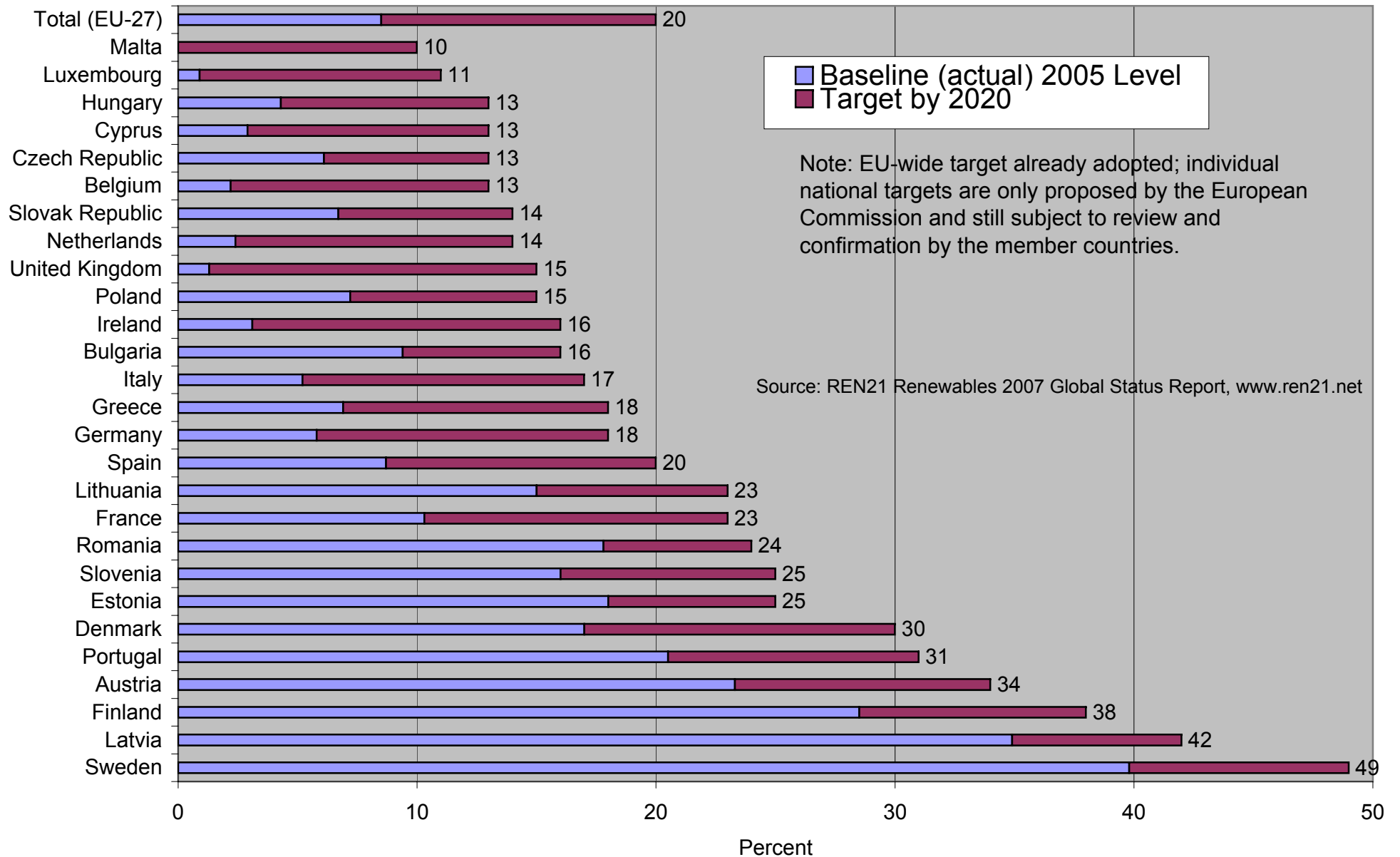
## Renewable Energy Targets (Goals) by a Future Year...

- Share of primary energy supply
- Share of final energy consumption
- Share of electricity generation
- Share of total energy used for transport fuels
- Share of heat and hot water production
- Specific capacity amounts added
- Specific levels of annual renewable energy production
- Number or share of homes with solar PV or solar hot water

Figure 11: EU Renewable Energy Targets -- Share of Electricity by 2010



**Figure 12. EU Renewable Energy Targets—Share of Final Energy by 2020**



**Table R7. Share of Primary and Final Energy from Renewables, Existing in 2006 and Targets**

Country/region	Primary energy (IEA method)		Final energy (EC method)	
	Existing share (2006)	Future target	Existing share (2005–06)	Future target
World	13%	—	18%	—
EU-25/EU-27	6.5%	12% by 2010	8.5%	20% by 2020
<b>Selected EU Countries</b>				
Austria	20%	—	23%	34% by 2020
Czech Republic	4.1%	8–10% by 2020	6.1%	13% by 2020
Denmark	15%	30% by 2025	17%	30% by 2020
France	6.0%	7% by 2010	10%	23% by 2020
Germany	5.6%	4% by 2010	5.8%	18% by 2020
Italy	6.5%	—	5.2%	17% by 2020
Latvia	36%	6% by 2010	35%	42% by 2020
Lithuania	8.8%	12% by 2010	15%	23% by 2020
Netherlands	2.7%	—	2.4%	14% by 2020
Poland	4.6%	14% by 2020	7.2%	15% by 2020
Spain	6.5%	12.1% by 2010	8.7%	20% by 2020
Sweden	28%	—	40%	49% by 2020
United Kingdom	1.7%	—	1.3%	15% by 2020
<b>Other Developed/OECD Countries</b>				
Canada	16%	—	20%	—
Japan	3.2%	—	3.2%	—
Korea	0.5%	5% by 2011	0.6%	—
Mexico	9.4%	—	9.3%	—
United States	4.8%	—	5.3%	—
<b>Developing Countries</b>				
Argentina	8.2%	—	—	—
Brazil	43%	—	—	—
China*	8%	15% by 2020	—	—
Egypt	4.2%	14% by 2020	—	—
India	31%	—	—	—
Indonesia	3%	15% by 2025	—	—
Jordan	1.1%	10% by 2020	—	—
Kenya	81%	—	—	—
Mali	—	15% by 2020	—	—
Morocco*	4.3%	10% by 2010	—	—
Senegal	40%	15% by 2025	—	—
South Africa	11%	—	—	—
Thailand*	4%	8% by 2011	—	—

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

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

**Table R9. Other Renewable Energy Targets**

Country	Target(s)
Australia	9.5 TWh of electricity annually by 2010 (RPS)
Brazil	3.3 GW added by 2006 from wind, biomass, small hydro
Canada	3.5% to 15% of electricity in 4 provinces (RPS); other types of targets in 5 provinces
China	300 GW hydro, 30 GW wind, 30 GW biomass, 1.8 GW PV, 300 million square meters solar hot water by 2020
Croatia	400 MW by 2010, excluding large hydropower
Dominican Republic	500 MW wind power capacity by 2015
India	10% of added electric power capacity during 2003–2012 (expected 10 GW). 10.5 GW total wind power existing by 2012; other long-term goals to 2032
Italy	3 GW of solar PV by 2016
Iran	500 MW of electricity output by 2010
Korea	1.3 GW of grid-connected solar PV by 2011, including 100,000 solar homes
Mexico	4 GW added by 2014
Morocco	1 GW wind power by 2012 and 400,000 square meters solar hot water added by 2015
New Zealand	30 PJ of added capacity (including heat and transport fuels) by 2012
Norway	7 TWh from heat and wind by 2010
Philippines	4.7 GW total existing capacity by 2013
Singapore	50,000 square meters (~35 MWth) solar hot water by 2012
South Africa	10 TWh added final energy by 2013
Switzerland	3.5 TWh from electricity and heat by 2010
Spain	500 MW solar power by 2010
Tunisia	500,000 square meters solar hot water by 2009 and 300 MW added wind by 2011
Turkey	2% of electricity from wind by 2010
Uganda	100 MW small hydro and 45 GW geothermal by 2017; other rural electricity and productive-uses targets
United States	5% to 30% (typical) of electricity in 26 states and District of Columbia (RPS)

## China Renewable Energy Targets

	<b>2006 actual</b>	<b>2010 target</b>	<b>2020 target</b>
Hydro power	130 GW	190 GW	300 GW
Wind power	2.6 GW	5 GW	30 GW
Biomass power	2.0 GW	5.5 GW	30 GW
Solar PV	0.08 GW	0.3 GW	1.8 GW
Solar hot water	100 million m <sup>2</sup>	150 million m <sup>2</sup>	300 million m <sup>2</sup>
Ethanol	1 million tons	2 million tons	10 million tons
Biodiesel	0.05 million tons	0.2 million tons	2 million tons
Biomass pellets	~ 0	1 million tons	50 million tons
Biogas and biomass gasification	8 million m <sup>3</sup> /year	19 billion m <sup>3</sup> /year	44 million m <sup>3</sup> /year
Share of primary energy	8%	10%	15%

## Selected Municipal Targets and Goals for Renewable Energy

City	Targets for renewable share of electricity	CO2 emissions reductions goals	Other targets/goals
Austin (TX), USA	30% by 2020	carbon-neutral by 2020	100% of own elec. use by 2012
Adelaide, Australia	15% by 2014	transport/buildings zero net emissions by 2010/12	2 MW of solar PV on residential and commercial buildings
Berlin, Germany		25% below 1990 by 2010	
Cape Town, South Africa	10% by 2020		10% of homes by 2010 with solar hot water
Chicago, USA			20% of own elec. use by 2006
Daegu, Korea			5% of energy by 2012
Freiburg, Germany	10% by 2010	25% below 1992 by 2010	
Gwangju, Korea		20% below 1990 by 2020	2% of energy by 2020
Leicester, UK			10% of energy by 2010 and 20% by 2020
London, UK		20% below 1990 by 2010	
Malmö, Sweden		25% below 1990 by 2012	
Melbourne		20% below 1996 by 2010	25% RE in buildings by 2010
New York, USA		7% below 1990 by 2012	
Oxford, UK			10% of homes by 2010 with solar hot water/PV
Portland (OR) USA		10% below 1990 by 2010	100% of own elec. use by 2010
Sacramento, USA	20% by 2011		
Salt Lake City, USA			10% of new building energy use
San Francisco, USA			1 MW/year added
Santa Monica, USA			100% of own use (current)
Sapporo, Japan		10% below 1990 by 2012	
Tokyo, Japan			20% of energy by 2020 (proposed); 5% of own use
Toronto, Canada		30% by 2020; 80% by 2050	
Vancouver, Canada		30% by 2020; 80% by 2050	

## Renewable Energy Promotion Policies and Examples

● Feed-in tariff	Portugal: 7.6 eurocents/kWh for wind for 15 years; Germany: 49 eurocents/kWh for solar PV for 20 years; declining rates year-by-year
● Renewable portfolio standard	California 20% by 2010
● Capital subsidies, grants, or rebates	Australia up to A\$8/watt rebate for solar PV
● Investment excise, or other tax credits	U.S. and Sweden 30% national tax credits for solar PV
● Sales tax, energy tax, VAT reduction	Many countries have some form of this policy
● Tradable renewable energy certificates	European voluntary energy certificate system trades renewable energy certificates (RECS)
● Energy production payments/ tax credits	U.S. Production Tax Credit of 2 cents/kWh, mostly has applied to wind power
● Net metering	Most states in the U.S. now allow
● Public investment, loans, or financing	Korea financing solar PV infrastructure; Ontario low-interest consumer loans
● Public competitive bidding	China national bidding 1-2 GW/year wind power

## Renewable Energy Promotion Policies and Examples (continued)

<ul style="list-style-type: none"> <li>● Government purchases of green power</li> </ul>	<p>U.S. city of Portland, Oregon purchases 100% of municipal needs as green power</p>
<ul style="list-style-type: none"> <li>● Building codes mandating solar hot water or solar PV on new buildings or for certain share of energy needs</li> </ul>	<p>German law for 14% of household heating and hot water energy from renewables for new buildings by 2009; Spain requires 30–70% of water heating energy on certain new buildings</p>
<ul style="list-style-type: none"> <li>● Solar hot water “market transformation”</li> </ul>	<p>Tunisia support for manufacturers and installers and new quality standards, along with subsidies</p>
<ul style="list-style-type: none"> <li>● Transmission pricing rules</li> </ul>	<p>U.S. national rule designates renewables as “conditional firm” service and sets special pricing and imbalance charges recognizing intermittancy</p>
<ul style="list-style-type: none"> <li>● Transmission planning mandates</li> </ul>	<p>Colorado utilities must identify windy areas and plan transmission capacity to those areas</p>
<ul style="list-style-type: none"> <li>● Biofuels blending mandates</li> </ul>	<p>E2 (2% ethanol) in New South Wales, increasing to E10 by 2011</p>
<ul style="list-style-type: none"> <li>● Biofuels tax exemptions</li> </ul>	<p>Many European countries offer 100% exemption</p>
<ul style="list-style-type: none"> <li>● Public transit use of biofuels or government vehicle use of biofuels</li> </ul>	<p>Betim, Brazil, and Stockholm, Sweden</p>

## Other Policies That Can Affect Renewable Energy Development

- Emissions standards, limits, and fees
- Fuel taxes
- Subsidies on fuel exploration, production, distribution
- Competitive wholesale power markets
- Regulatory “unbundling” of generation, transmission, and distribution
- Transmission access and “wheeling” policies
- Regulatory provision for competition by power producers/sellers at the retail level
- Carbon taxes
- International voluntary carbon trading
- Adherence to Kyoto protocol and possible successors

# Barriers to Renewable Energy

## A. Costs and Pricing

1. Subsidies for competing fuels
2. High initial capital costs
3. Difficulty of fuel price risk assessment
4. Unfavorable power pricing rules
5. Transaction costs
6. Environmental externalities

## B. Legal and Regulatory

1. Lack of legal framework for independent power producers
2. Restrictions on siting and construction
3. Transmission access
4. Utility interconnection requirements
5. Liability insurance requirements

## C. Market Performance

1. Lack of access to credit
2. Perceived technology performance uncertainty and risk
3. Lack of technical or commercial skills and information

**Table 2. Renewable Energy Promotion Policies**

Country	Feed-in tariff	Renewable port-folio 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
<b>Developed and transition countries</b>										
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	(*)	(*)	✓	✓	(*)	(*)	✓	(*)	(*)	(*)

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

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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	34	Italy, Israel, Nicaragua, Prince Edward Island (Canada), Andhra Pradesh and Madhya Pradesh (India)
2005	41	Karnataka, Uttaranchal, and Uttar Pradesh (India); China; Turkey; Ecuador; Ireland
2006	44	Ontario (Canada), Argentina, Thailand
2007	46	South Australia (Australia), Croatia

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

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Year	Cumulative Number	Countries/States/Provinces Added
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

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**Table R12. Biofuels Blending Mandates**

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<b>Country</b>	<b>Mandate</b>
Australia	E2 in New South Wales, increasing to E10 by 2011; E5 in Queensland by 2010
Argentina	E5 and B5 by 2010
Bolivia	B2.5 by 2007 and B20 by 2015
Brazil	E22 to E25 existing (slight variation over time); B2 by 2008 and B5 by 2013
Canada	E5 by 2010 and B2 by 2012; E7.5 in Saskatchewan and Manitoba; E5 by 2007 in Ontario
China	E10 in 9 provinces
Colombia	E10 existing; B5 by 2008
Dominican Republic	E15 and B2 by 2015
Germany	E2 and B4.4 by 2007; B5.75 by 2010
India	E10 in 13 states/territories
Italy	E1 and B1
Malaysia	B5 by 2008
New Zealand	3.4 percent total biofuels by 2012 (ethanol or biodiesel or combination)
Paraguay	B1 by 2007, B3 by 2008, and B5 by 2009
Peru	B5 and E7.8 by 2010 nationally; starting regionally by 2006 (ethanol) and 2008 (biodiesel)
Philippines	B1 and E5 by 2008; B2 and E10 by 2011
South Africa	E8-E10 and B2-B5 (proposed)
Thailand	E10 by 2007; 3 percent biodiesel share by 2011
United Kingdom	E2.5/B2.5 by 2008; E5/B5 by 2010
United States	Nationally, 130 billion liters/year by 2022 (36 billion gallons); E10 in Iowa, Hawaii, Missouri, and Montana; E20 in Minnesota; B5 in New Mexico; E2 and B2 in Louisiana and Washington State; Pennsylvania 3.4 billion liters/year biofuels by 2017 (0.9 billion gallons)
Uruguay	E5 by 2014; B2 from 2008-2011 and B5 by 2012

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**Table 3. Selected Cities with Renewable Energy Goals and/or Policies**

City	Renewable energy goals	CO <sub>2</sub> reduction goals	Policies for solar hot water	Policies for solar PV	Urban planning, pilots, and other policies
Adelaide, Australia	✓	✓			✓
Austin (Texas), USA	✓	✓			✓
Barcelona, Spain			✓		
Berlin, Germany		✓	✓	✓	
Betim, Brazil		✓	✓		✓
Cape Town, South Africa	✓	✓			✓
Chicago, USA	✓				
Daegu, Korea	✓	✓			✓
Freiburg, Germany	✓	✓	✓	✓	✓
Gwangju, Korea	✓	✓			✓
The Hague, Netherlands		✓			
Leicester, UK	✓				✓
London, UK		✓			
Malmö, Sweden		✓			✓
Melbourne, Australia	✓	✓			✓
Mexico City, Mexico				✓	✓
Minneapolis, USA	✓				✓
Nagpur, India		✓	✓	✓	
New York, USA		✓		✓	✓
Oxford, UK	✓	✓	✓	✓	✓
Portland, United States	✓	✓	✓	✓	✓
Rizhao, China			✓	✓	
Salt Lake City, USA	✓	✓			✓
Santa Monica, USA	✓				✓
São Paulo, Brazil			✓		
Sapporo, Japan		✓			✓
Stockholm, Sweden	✓	✓			✓
Toronto, Canada		✓			
Tokyo, Japan	✓		✓	✓	✓
Townsville, Australia			✓	✓	
Vancouver, Canada		✓			
Växjö, Sweden	✓	✓	✓	✓	✓
Woking, UK	✓	✓	✓	✓	✓

## Spain Solar Hot Water Ordinances

- Barcelona started in 2000 to require solar hot water in all new buildings and major renovations above a specific size (typically all commercial buildings and residential buildings of 16 or more households). In 2005, eliminated minimum size requirement.
- Barcelona requirement is for 60% of hot water energy to come from solar.
- Barcelona was followed by 70 municipalities and cities throughout Spain enacting similar ordinances
- March 2006: Spain enacted a national building ordinance requiring solar hot water and solar PV in new construction and renovation for larger buildings.
- National ordinance requires 30-70% of hot water energy from solar, depending on consumption level, geographical location, and back-up fuel.
- National ordinance applies to several types of buildings: shopping centers > 3,000 m<sup>2</sup>, warehouses > 10,000 m<sup>2</sup>; office buildings > 4,000 m<sup>2</sup>; hotels > 100 rooms; hospitals > 100 rooms; convention centers > 10,000 m<sup>2</sup>

## Policy Landscape

- Policy targets exist in at least 66 countries worldwide, including 22 developing countries, all 27 EU countries, and many states/provinces in the US and Canada.
- At least 60 countries worldwide now have some type of renewable energy promotion policy, including 23 developing countries. Several more developing countries are actively engaged in enacting policies.
- At least 37 countries and 9 states/provinces have adopted feed-in policies, more than half of which have been enacted since 2002.
- At least 44 states, provinces, and countries have enacted renewable portfolio standards (RPS), half since 2003.
- Many countries continue to actively supplement, revise, and clarify targets and promotion policies, including feed-in tariffs and rules.
- Targets for biofuels as a share of transport energy exist in EU (5.75% by 2010 and 10% by 2020), France (10% by 2015), Belgium (5.75% by 2010), and Japan (5% by 2030).
- Mandates for blending biofuels into vehicle fuels have been enacted in at least 36 states/provinces and 17 countries. Most are 10-15% for ethanol and 2-5% for biodiesel.

## Policy Landscape (continued)

- US Renewable Fuels Standard requires 28 billion liters/year by 2012 (vs. 18 bly in 2006)
- Biofuels tax exemptions have been enacted in a growing number of countries during 2005-2007, including Argentina, France, Germany, Greece, Ireland, Italy, Lithuania, Slovenia, South Africa, Spain, Sweden, and UK. Many are for 100% tax exemptions.
- Solar PV policies continue to multiply, including:
  - feed-in tariffs in Europe (typical 38-55 eurocents/kWh for small installations in Belgium, Czech Republic, France, Germany, Greece, Italy, Spain); and at state/province levels, including Washington State (USA), Ontario (Canada), State of South Australia
  - national building code requirement in Spain for solar PV on new buildings
  - U.S. national tax credit (30%)
  - capital subsidies in several U.S. states (\$0.5-4/watt), Australia (A\$4/watt), Korea (70% subsidy), 300 Japanese municipalities, UK, and Sweden.
- Solar hot water tax credits and subsidies exist in many jurisdictions.
- There are more than 4 million green power consumers in Europe, US, Canada, Australia, and Japan, most of these in Europe.
- Municipalities around the world are also setting targets for future shares of renewable energy, CO<sub>2</sub>-reduction targets, and enacting policies for solar PV and solar hot water.