

# Government Policies for Promoting and Managing the Production and Consumption of Bioenergy

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# 1 Introduction and Scope

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Governments around the world are pursuing policies to promote and manage the production and consumption of energy from biomass. As countries strive to reduce greenhouse gas emissions, increase energy security and expand export markets, biomass is becoming an increasingly important component of national energy plans.

While the potential to produce energy from biomass is significant, there are a number of technical and economical barriers that currently limit bioenergy<sup>1</sup> production and consumption. Government policies have been implemented to help overcome these challenges, to foster growth in the bioenergy industry and to increase market penetration of new technologies.

The purpose of this report is to describe existing international government policies for managing and promoting the production and consumption of bioenergy in selected countries around the world and to compare such policies with those in place in Canada. In doing so, we will benchmark the range and scale of policy options that have been implemented in select jurisdictions around the world. We will focus our efforts on national policies in Norway, Sweden, Finland, the United States, Brazil, South Africa, Germany and the United Kingdom. Note that this work is not intended to be a comprehensive evaluation of the bioenergy policies in the selected regions. Rather, it is designed to be an inventory of sorts of international bioenergy policies. As a result, we do not include an analysis of the political, legal or market drivers behind bioenergy production. We also do not assess the relative success of such policies in promoting bioenergy production and consumption. Subsequent work in this area should consider the drivers behind the policies in the particular countries as well as the success of those policies in overcoming barriers and facilitating bioenergy market penetration.

Section 2 presents information on current bioenergy consumption, bioenergy production and consumption drivers, factors limiting the use of biomass, biomass resource potential and the types of policies and programs that have been implemented in various regions. Sections 3 to 10 present the policies in place in Sweden, the United States, Finland, the United Kingdom, Germany, Norway, Brazil and South Africa respectively. Section 11 is an international comparison of all of the policies presented in this report. Section 12 presents policies in place in Canada and section 13 concludes with a comparison of Canadian policies with those of the other regions included in this study.

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<sup>1</sup> For the purposes of this report, bioenergy is taken to include both biofuels (such as ethanol, biodiesel, methanol, biogas and bio-oil) and electricity derived from biomass sources.

## 2 Background

Biomass is an important component of the energy balance of the world. Indeed, biomass constitutes approximately 14% of total final energy demand globally — more than any other renewable energy source.<sup>2</sup> Although wood for heating is the major use of biomass, the use of urban and industrial waste to produce electricity and heat as well as biofuels for transportation is becoming increasingly important to the biomass energy sector. As well, the use of solid biomass or biogas is expanding in modern combustion systems, such as cogeneration or industrial processes.

Table 1 shows for various countries the total energy consumption, as well as the portion of that total that is met with renewables<sup>3</sup> and with biomass. As the table reveals, the portion of total primary energy supply (TPES) that is derived from renewables varies significantly from country to country, from a low of 1.1% in the United Kingdom to a high of 52.8% in Norway. The share of biomass in TPES also varies, from a low of 0.9% in the United Kingdom to a high of 20.4% in Finland.

**Table 1. Energy Supply and Share of Renewables and Bioenergy, 2000**

Country	Total Primary Energy Supply (TPES) (Mtoe)	Share Of Total Renewables In Tpes (%)	Share Of Bioenergy In Tpes (%)
Australia	110.2	6.3	4.9
Austria	28.6	23.8	10.9
Belgium	59.2	1.3	1.2
Canada	251.0	16.8	4.5
Denmark	19.5	11.3	8.8
Finland	33.1	24.2	20.4
France	257.1	6.8	4.5
Germany	339.6	3.3	2.5
Greece	27.8	5.3	3.7
Hungary	24.8	1.6	1.5
Ireland	14.6	1.8	1.2
Italy	171.6	5.3	1.3
Japan	524.7	3.3	1.1
Luxemburg	3.7	1.5	1.2
Netherlands	75.8	2.5	2.3
New Zealand	18.6	33.5	6.5
Norway	25.6	52.8	5.3
Portugal	24.6	12.7	8.3
Spain	124.9	5.9	3.6
Sweden	47.5	31.9	17.5
Switzerland	26.6	18.3	6.0
Turkey	77.1	12.5	8.4
United Kingdom	232.6	1.1	0.9
United States	2300.0	5.0	3.4
Total OECD*	5316.9	6.2	3.4

\* Organisation for Economic Co-operation and Development.

Source: International Energy Agency. 2002. *Renewables in Global Energy Supply: An IEA Fact Sheet*. France: International Energy Agency.

<sup>2</sup> Janssen, Rodney. 1999. *The Evolving Renewable Energy Market*. France: International Energy Agency.

<sup>3</sup> According to the International Energy Agency “renewables” includes combustible renewables and waste, hydro, geothermal, solar, wind, tidal and wave power.

## 2.1 Bioenergy Production and Consumption Drivers

In recent years, substantial progress in the form of increased public awareness and consumer support as well as improved technological reliability and reduced costs has been made in the use of biomass and other renewable energy sources. Notwithstanding the implementation of government policies to promote the production and consumption of biomass, several factors are driving continued and increased use of biomass. These factors include the following:

1. **Environmental Drivers** — Countries have pursued increased production and consumption of fuels from biomass as a means to reduce local air pollutants and achieve greenhouse gas emission reductions. A major objective of the greenhouse gas emission reductions is to meet targets as established in the Kyoto Protocol.
2. **Decommissioning of Nuclear Power Plants** — In 1997, the Swedish Government announced plans to decommission nuclear power plants in the country. This decommissioning is to be accomplished by increasing energy efficiency and by increasing sustainable energy production using environmentally acceptable technologies. In 2001, the federal government of Germany and the operators of nuclear power plants in that country signed an agreement that is serving as the basis for terminating the use of nuclear power in Germany. As nuclear power plants in these countries are shut down, alternative sources of energy will need to be developed. Biomass is poised to play a significant role in the development of new energy sources. In fact, biomass is expected to be the most important energy source replacing nuclear power in Sweden.<sup>4</sup>
3. **Energy Security** — Many countries currently rely on imports to meet their domestic energy demands. Reliance on imported energy makes countries vulnerable to disruptions in energy supply and volatile prices. Countries can achieve greater self-reliance by developing local, sustainable energy resources such as biomass. Furthermore, in some nations, developing local energy systems based on biomass resources can reduce a portion of the increasing trade deficit caused by the necessity to import oil.
4. **Economic Diversification** — Economic diversity protects economies from boom and bust cycles that can result from excessive reliance on any one particular market. When economies are diverse, if one or two sectors experience a downturn fewer people are affected because there are other economic activities on which portions of the population rely. Investing in renewable energy such as biomass can help diversify the economy. Instead of one main source of energy supply (such as oil), there can be numerous sources spread across a range of technologies depending on the resources available in a particular location (wind, solar, biomass, etc.).
5. **Employment** — Research suggests that renewable energy projects create more jobs per dollar invested than conventional energy-supply projects. In fact, a review of some 30 studies of employment in North American energy sectors concluded that renewable energy projects can create twice as many jobs as conventional energy projects per dollar invested.<sup>5</sup>
6. **Export Market Development** — The low-impact renewable energy industry (not including large hydro-electric power stations and biomass for residential wood stoves) has an annual turnover worldwide of about US\$7 billion. This industry is expected to grow to US\$82 billion by the year

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<sup>4</sup> Helby, Peter. 1998. *Renewable Energy Projects in Sweden: An Overview of subsidies, taxation, ownership and finance*. Sweden: Department of Environmental and Energy Systems Studies.

<sup>5</sup> Pembina Institute. 1997. *Comparative Analysis of Employment from Air Emission Reduction Measures*. Prepared for Environment Canada- Global Air Issues Branch. Calgary, AB: Pembina Institute.

2010.<sup>6</sup> By establishing themselves as leaders in this growing industry, countries pursuing renewable energy technologies will gain a competitive advantage and have access to expanding export markets in the future.

7. **Regional Development** — To the extent that biomass supplies come from the agricultural sector, the use of biomass as a source of energy provides farmers with a new and alternative source of income. In addition, when bioenergy generation facilities are located close to biomass supplies (e.g., woodwaste, plantations, agriculture wastes), new employment opportunities will be created in rural communities.
8. **Off-grid Energy Supply** — Biomass and other renewable energy sources offer a means to provide remote communities with energy systems while avoiding the need to import fuel across long distances and extend existing electricity grid networks.
9. **Availability of Supply** — To varying degrees, biomass for bioenergy production is available around the world. As is described in Section 2.3 below, this is especially true in Canada where the potential to produce bioenergy from residues (forest, manure and agriculture) and plantations is significant.
10. **Biomass Waste Management** — Some jurisdictions (e.g., British Columbia) are phasing out the use of incinerators such as beehive burners to dispose of waste from saw and pulp mills. Other jurisdictions (e.g., Sweden) are banning the disposal of organic and combustible waste at landfill sites. These two factors make converting biomass to bioenergy an increasingly attractive alternative.

The combination of the drivers described above and the implementation of government policies to promote the production and consumption of bioenergy has made biomass the most significant renewable energy source in the world. In 2000, 79% of global renewable energy supplies were derived from biomass (compared with 17% from hydro and 4% from other sources).<sup>7</sup> Furthermore, the use of biomass is predicted to continue to increase in the future. Research by the European Renewable Energy Study predicted annual increases in electricity from biomass of 3.7% between 1995 and 2020 for the European Union (EU). The same research forecasts growth in heat from biomass of 1.8% per year. The use of ethanol and biodiesel are predicted to experience the strongest growth: 10.9% annually.<sup>8</sup>

This predicted growth in the biomass sector is, however, only expected to essentially keep pace with growth in energy consumption in general. Thus, while the use of renewable energy including biomass will increase overtime, the share of renewable energy in the total primary energy supply will not expand without implementation of government policies to facilitate technological developments and market penetration. Government intervention is required to address and overcome the technological and economic challenges that currently limit the use of biomass and other renewable energy sources.

## 2.2 Factors Limiting the Use of Biomass

Factors that currently limit the use of biomass for energy production and consumption can be grouped into the following broad categories: factors limiting biomass availability; factors limiting biomass

<sup>6</sup> Pape-Salmon, Andrew, Jonathon Dogterom, Carissa Wieler, and Mark Anielski. 2003. *Low-Impact Renewable Energy Policy in Canada: Strengths, Gaps and a Path Forward*. Calgary, AB: Pembina Institute.

<sup>7</sup> International Energy Agency. 2002. *Renewables in Global Energy Supply*. An IEA Fact Sheet. France: International Energy Agency.

<sup>8</sup> Janssen, Rodney. Year. *The Evolving Renewable Energy Market*. France: International Energy Agency.

harvesting and supply systems; factors limiting biomass conversion; and factors limiting bioenergy market development. Each of these categories is elaborated on below.

**1. Factors Limiting Biomass Availability:**

- Cost of biomass feedstock production and delivery.
- Impacts on soil sustainability.
- Access to agricultural and other land for biomass production.
- Cost of biomass recovery from agricultural facilities and landfill operations.

**2. Factors Limiting Biomass Harvesting and Supply Systems:**

- Variable and/or unfavourable climatic conditions such as limited moisture, nutrients and sunlight.
- Complexity of collecting, storing and combining in an environmentally sound manner multiple feedstocks for diverse applications.
- Development of infrastructure for handling material including collection and distribution systems.
- Identification of appropriate locations for processing and conversion facilities.<sup>9</sup>

**3. Factors Limiting Biomass Conversion:**

- Limited knowledge of plant biochemistry and enzymes in the context of biofuel production.
- Lack of scientific methods to produce and prepare plants and residues so that they meet specifications for end-use applications.
- Cost of environmentally sound thermochemical conversion technologies to convert biomass feedstocks into useful electric power, heat and potential fuels and products.
- Cost of environmentally sound bioconversion processes/technologies for commercial application of a range of biobased fuels and products.
- Need for biorefineries that efficiently separate biomass raw materials into individual components and convert these components into marketable products, including biofuels, electricity from biomass, biochemicals and bioproducts.

**4. Factors Limiting Bioenergy Market Development:**

- Access to and capacity of transmission lines to cost-effectively connect production locations to the market.
- High initial investment costs and limited access to favourable financing.
- Lack of consumer confidence in products.
- Limited access to final products.
- Low prices for conventional energy sources and lack of environmentally oriented fuel pricing.

## 2.3 Biomass Resource Potential

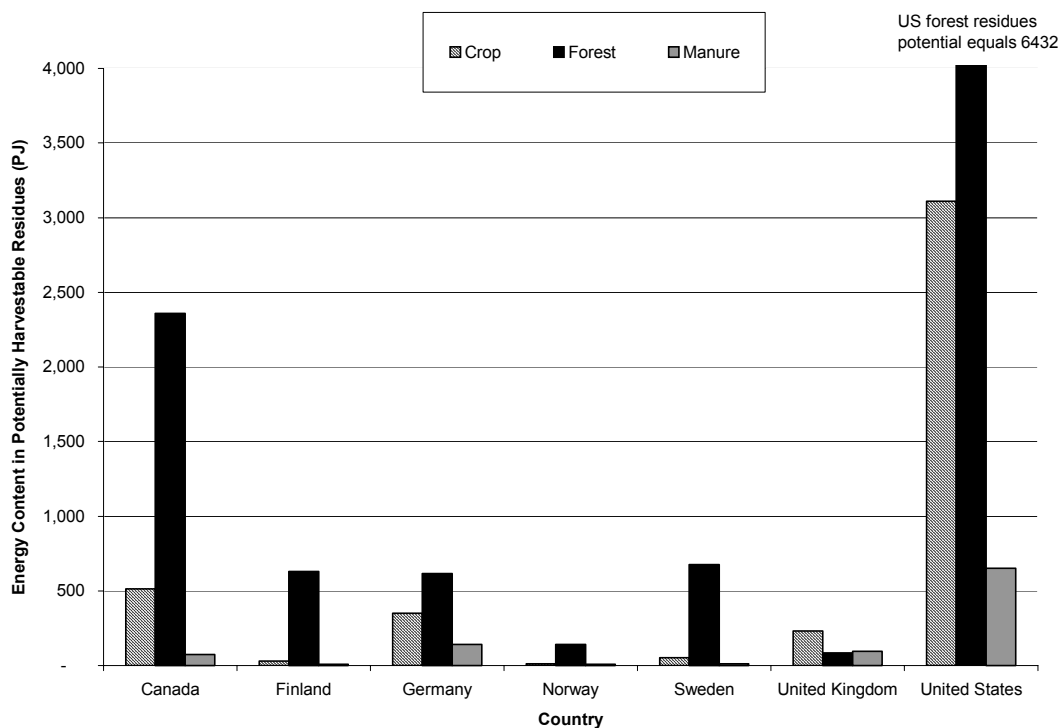
Government policy can play a key role in overcoming the technical and economic challenges described above. Should such policies be successful, research suggests that the use of biomass as a source of energy has great potential, especially in Canada. The following figures demonstrate the energy potential that exists in selected Organisation for Economic Cooperation and Development (OECD) countries. Figures 1 and 2 show energy potential from residues and plantations respectively. Figure 3 shows potential

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<sup>9</sup> To maximize rural development, minimize handling costs and minimize negative environmental impacts, such facilities are often in close proximity to biomass resources.

electricity production from biomass in selected OECD countries. The figures show that the potential to use biomass as a source for energy in Canada is particularly substantial.

**Figure 1. Energy Potential from Residues (Crop, Forest and Manure) in Selected OECD Countries**

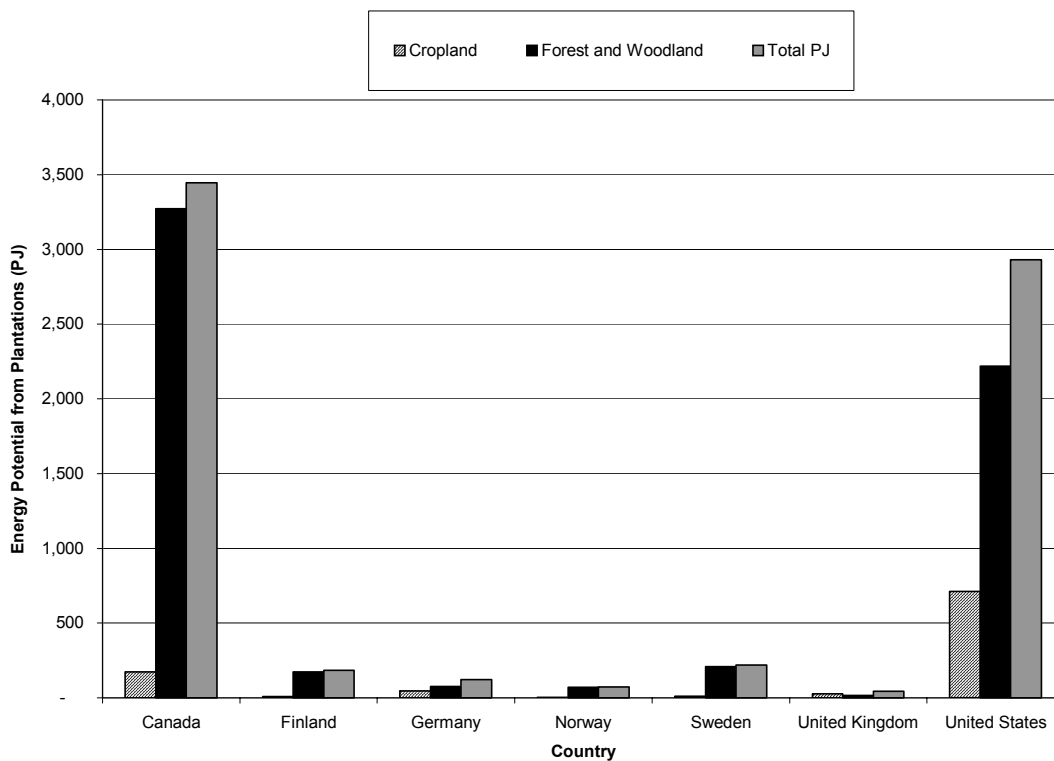


Source: Bauen, Ausilio, Jeremy Woods, and Rebecca Hailes. 2003. *Bioelectricity Vision: Achieving 15% of Electricity from Biomass in OECD Countries by 2020*. Brussels, Belgium: WWF.

Of the countries presented above, only the United States has greater potential than Canada to generate energy from residues. In Canada, energy from forest residues is the largest resource for energy generation.

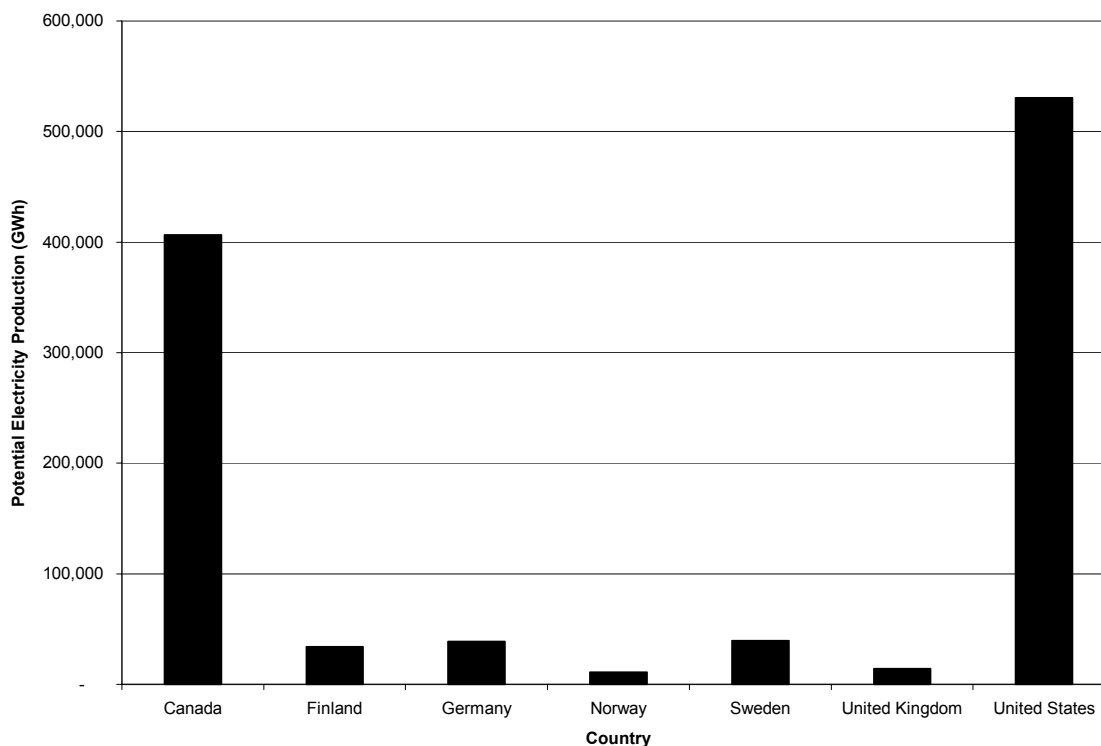


**Figure 2. Energy Potential from Energy Plantations in Selected OECD Countries**



Source: Bauen, Ausilio, Jeremy Woods, Rebecca Hailes. 2003. *Bioelectricity Vision: Achieving 15% of Electricity from Biomass in OECD Countries by 2020*. Brussels, Belgium: WWF

The potential to generate energy from plantations in Canada is significant; more than any other country presented above. Practically all of the potential in Canada is from forest and woodland plantations.

**Figure 3. Potential Electricity Production from Biomass in Selected OECD Countries**

Source: Bauen, Ausilio, Jeremy Woods, and Rebecca Hailes. 2003. *Bioelectricity Vision: Achieving 15% of Electricity from Biomass in OECD Countries by 2020*. Brussels, Belgium: WWF.

The figures above demonstrate the vast potential to use biomass as a source of energy, particularly in Canada. Thus, while the supply of biomass resources appears to be significant, the economic and technological barriers described above limit the full exploitation of this relatively untapped renewable resource. Government policies are therefore needed to identify and develop viable resources, to overcome technological hurdles and to mitigate economic barriers. The success of such policies will depend to a certain extent on the integration of energy, environment, agriculture and forestry policies.

## 2.4 Types of Policies and Programs

To help overcome the various barriers associated with bioenergy production and consumption, and to foster growth in the bioenergy industry, governments around the world have implemented a broad range of policies and programs, including

1. **Research and development programs.**
2. **Loans** and repayable funds for companies and organizations.
3. Expenditures related to **program activities** such as establishing research groups, networks and other coordinating bodies.
4. **Financial incentives** including tax measures (tax credits, exemptions and rebates) and direct subsidies and grants.
5. **Procurement programs** and quotas or guaranteed purchases.
6. Investment in prototype and **demonstration** technologies and products.
7. **Information and education** programs.
8. **Standards and guidelines** including regulations and consumption targets.

These policies are targeted at different aspects or sub-sectors of the biomass economy including

**1. Biomass Availability:**

- Policies targeted at municipal waste, forestry/agricultural residues and waste, aquaculture and dedicated crops.
- Policies designed to support the production of dedicated biomass crops.
- Policies designed to support a shift from conventional agricultural production towards production of dedicated biomass crops.
- Policies designed to facilitate biomass crop inventories and the production of biomass maps.

**2. Biomass Harvesting and Supply Systems:**

- Policies designed to target transportation issues.
- Recovery of waste fuels and diversion of existing biomass sources.
- Direct incentives to increase biomass harvesting.

**3. Biomass Conversion** (physical, chemical, advanced combustion, bioprocesses and green chemistry conversion processes):

- Policies designed to support infrastructure development related to conversion processes.
- Policies geared toward large-scale centralized plants versus a system of smaller-scale decentralized plants.
- Policies designed to address technical barriers.
- Demonstration and pilot projects.

**4. Bioenergy Market Development:**

- Policies targeted at education/awareness.
- Procurement and quota programs.
- Policies that address the issue of integration into existing fuelling systems.
- Policies that directly incent bioproduct consumption.

The following sections present the key policies and programs in place in the selected regions. These sections provide a snapshot of the current policy framework related to bioenergy for various parts of the world. For each policy and/or program, the type of initiative and the relevant government department are identified. Also provided are a description of each initiative, the year of implementation, the policy objective and the main sub-sector targeted. For each region, the policies are then summarized in a policy trend identification matrix (table 3).

**Table 2. Policy Trend Identification Matrix**

<b>Target</b>	<b>R&amp;D</b>	<b>LNS</b>	<b>PRG</b>	<b>FI</b>	<b>PRC</b>	<b>DEM</b>	<b>INF</b>	<b>STD</b>
Availability								
Harvesting and Supply Systems								
Conversion								
Market Development								

R&amp;D: Research and Development

LNS: Loans

PRG: Program Activities

FI: Financial Incentives

PRC: Procurement Programs

DEM: Demonstration Programs

INF: Information and Education Programs

STD: Standards and Guidelines

Although the international reviews presented in the following sections are not comprehensive, they do include the key policies and programs related to biomass and bioenergy for each region. These policies were chosen either because they explicitly relate to bioenergy, or because they apply to renewable energy in general and have a significant focus on the production and consumption of bioenergy.

### 3 Policies in Place in Sweden

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**Name of initiative:** Sustainable Production of Forest Fuels Research Program

**Type of initiative:** Research and development

**Objective:** To create a basis for sustainable production of forest fuels, with proper allowance for ecological, economic and technical potentials and limitations.

**Relevant government department:** National Energy Agency

**Description:** This is one of two components of the Biofuels and the Environment Program run by the Swedish National Energy Agency. The program is concerned with silvicultural and ecological aspects, such as full tree extraction, nutrient compensation and new silviculture systems that can result in greater fuel production. The total budget for this program is Swedish Kronar (SEK) 32 million (CAN\$6 million).

**Year of implementation:** 2000 (in place until 2004)

**Sub-sector targeted:** Biomass availability

**Name of initiative:** Bioenergy and Biological Diversity Research Program

**Type of initiative:** Research and development

**Objective:** To identify a system for biofuel production from forest and agricultural land that has the least possible adverse effects on nature and biological diversity.

**Relevant government department:** National Energy Agency

**Description:** This is one of two components of the Biofuels and the Environmental Program run by the Swedish National Energy Agency. This program is designed to gather knowledge on how a practical and economically viable system for the production of biofuels from forest and agricultural land should be structured to have the least possible adverse effect on nature and biological diversity. The annual budget for this program is SEK 12 million (CAN\$2 million).

**Year of implementation:** 2000 (in place until 2004)

**Sub-sector targeted:** Biomass availability

**Name of initiative:** Agriculturally Produced Solid Biofuels

**Type of initiative:** Research and development

**Objective:** To solve biological and technical problems associated with cultivation that impede increased production of biofuels from agricultural land.

**Relevant government department:** National Energy Agency

**Description:** The research taking place as part of this initiative is intended to improve knowledge of field-grown biofuels, and particularly production potential and production yields, and of new applications of biofuel cultivation. It is also hoped that this research will lead to a general improvement in the overall knowledge of biofuel of Swedish scientists working in this sector. Research focuses on willow although a limited amount of work is also being done on reed canary grass. The annual budget for this program is SEK 12 million (CAN\$2 million).

**Year of implementation:** 2000 (in place until 2004)

**Sub-sector targeted:** Biomass availability

**Name of initiative:** Energy Forest Plantation Grants

**Type of initiative:** Financial incentive

**Objective:** To increase biomass production from forests.

**Relevant government department:** Ministry of Industry

**Description:** There is currently a grant for establishing energy forest plantation (salix) of SEK 5,000 (CAN\$861) per hectare. The Swedish government earmarks SEK 5,000,000 (CAN\$861,000) every year

for this program. The authorities grant aid to applicants who establish fast growing trees and cultivate the crop on set-aside land.<sup>10</sup>

**Year of implementation:** This type of grant has existed since 1989, but has varied considerably in the amounts and conditions over time.

**Sub-sector targeted:** Biomass availability

**Name of initiative:** Energy from Waste

**Type of initiative:** Research and development

**Objective:** To increase knowledge of the best way to extract energy from waste.

**Relevant government department:** National Energy Agency

**Description:** The main research areas for this project are combustion and gasification, system studies and life cycle assessment, and anaerobic treatment of organic waste. The results from the program will be useful to central and local authorities planning and handling different kinds of waste, and for operating companies conducting waste treatment. The budget for this program is approximately SEK 9 million (CAN\$1.6 million) per year.

**Year of implementation:** The second stage of this research program runs from 2000 to 2003.

**Sub-sector targeted:** Biomass conversion

**Name of initiative:** Ethanol from Forest Raw Materials Research Program

**Type of initiative:** Research and development and demonstration

**Objective:** To provide technical, scientific and economic support for the production of ethanol on a larger scale and at a lower cost.

**Relevant government department:** National Energy Agency

**Description:** This program supports the production of ethanol from raw materials. The program is comprised of research, technical developments and pilot-scale production. Areas covered by the program include hydrolysis by enzymes and oxygen, fermentation of sugars, utilization of lignin residues and process technology development. In December 2001, a decision was made to build a pilot plant at Örnköldsvik, in the north of Sweden. Research at this plant addresses problems in all steps of the ethanol process, as well as technical and economic studies. A process development unit has been built at the Lund Institute of Technology, which allows studies of various process steps or process concepts in larger than ordinary laboratory scale. Process concepts studied include both acid and enzymatic hydrolysis, separate hydrolysis and fermentation as well as simultaneous saccharification and fermentation. A total of SEK 30 million (CAN\$5 million)/year is available for this project (total budget is SEK 210 million (CAN\$37 million)).

**Year of implementation:** 1998 (in place until 2004)

**Sub-sector targeted:** Biomass conversion

**Name of initiative:** Small-scale Combustion of Biofuels Research Program

**Type of initiative:** Research and development

**Objective:** The objective of this program is to encourage the creation of pellet- and wood chip-fired systems of ratings up to 10 MW with the same performance and user-friendliness as oil-fired boilers.

**Relevant government department:** National Energy Agency

**Description:** This research is intended to help improve efficiency, thus reducing the environmental impacts of small-scale combustion of biofuels. It is also expected to contribute to greater use of biofuels. This program has been running since 1993 and is now in its third stage. The annual budget is SEK 22 million (CAN\$4 million).

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<sup>10</sup> Note that this policy is consistent with Article 6 in European Council Regulation (EC) No. 1251/1999, which establishes a support system for producers of certain arable crops. This regulation states that "Member States shall be authorized to pay national aid up to 50 % of the costs associated with establishing multi-annual crops intended for biomass production on set aside land."

**Year of implementation:** 1993 (in place until 2004)

**Sub-sector targeted:** Biomass conversion

**Name of initiative:** Combustion and Gasification of Solid Biofuels for Combined Heat and Power Production

**Type of initiative:** Research and development

**Objective:** To reduce CO<sub>2</sub> emissions by increasing the competitiveness and efficiency of combined heat and power production with renewable fuels.

**Relevant government department:** National Energy Agency

**Description:** This is a research program focusing on combustion and gasification in combined heat and power production. The program strongly focuses on renewable fuels, especially municipal solid waste and forestry residues. The research is mainly carried out at universities and technical institutes. The annual budget for this program is EUR 1.7 million (CAN\$2.7 million).

**Year of implementation:** 2000 (in place until 2004)

**Sub-sector targeted:** Biomass conversion

**Name of initiative:** Biofuel-fired Combined Heat and Power Investment Grants for New Plants

**Type of initiative:** Financial incentive

**Objective:** To achieve an expansion of at least 0.75 TWh/year of new electricity production from biomass.

**Relevant government department:** National Energy Agency

**Description:** These grants are available to encourage the expansion of biofuel-fired combined heat and power production. They are also available to wind power and small-scale hydropower. Grants are available at a rate of SEK 4000 (CAN\$702) per installed kW of electricity production capacity, up to a maximum of 25% of the capital cost of plants for biofuelled combined heat and power production. SEK 450 million (CAN\$79 million) has been assigned for this and the complementary initiative below over a five-year period.

**Year of implementation:** 1997

**Sub-sector targeted:** Bioenergy market development

**Name of initiative:** Biofuel-fired Combined Heat and Power Investment Grants for Retrofitting Existing Plants

**Type of initiative:** Financial incentive

**Objective:** To achieve an expansion of at least 0.75 TWh/year of new electricity production from biomass.

**Relevant government department:** National Energy Agency

**Description:** Existing non-combined heat and power heating plants that are retrofitted to combined heat and power based on biofuels receive 25% of the retrofit costs, up to a maximum of SEK 4000 (CAN\$702)/kW of installed capacity. SEK 450 million (CAN\$79 million) has been assigned for this and the complementary initiative above over a 5-year period.

**Year of implementation:** 1997

**Sub-sector targeted:** Bioenergy market development

**Name of initiative:** Pilot Project Tax Relief

**Type of initiative:** Financial incentive

**Objective:** To increase the use of biofuels in Sweden.

**Relevant government department:** Ministry of Finance

**Description:** Fossil based fuels in Sweden are subject to both a carbon dioxide tax and an energy tax. The Swedish carbon dioxide tax was set at about EUR 0.028 (CAN\$0.04) per kg of carbon dioxide in 1991. In 1993 it was raised to EUR 0.036 (CAN\$0.057) per kg and in 1996 further raised to EUR 0.04 (CAN\$0.063) per kg. In pilot projects in Sweden, ethanol and rapeseed methyl ester (RME) are exempt

from carbon taxes as well as energy taxes. Biofuels used for heat and electricity are also exempt from these taxes. In all cases, exemptions are time limited and will be phased out over time.

**Year of implementation:** 1991

**Sub-sector targeted:** Bioenergy market development

**Name of initiative:** Tax Break for Alternative Fuelled Employee Automobiles

**Type of initiative:** Financial incentive

**Objective:** The objective of the policy is to increase the number of environmentally friendly cars on Swedish roads.

**Relevant government department:** Ministry of Finance

**Description:** Employees in Sweden who are provided alternative-fuel automobiles by their employers will be eligible for tax breaks. The tax credit on company cars was originally calculated at 20% of the value of the car. The taxable benefit will be increased by 40% for cars either entirely or partly powered by electricity and by 20% for those powered by biogas.

**Year of implementation:** 2002

**Sub-sector targeted:** Bioenergy market development

**Name of initiative:** Alternative Motor Fuels

**Type of initiative:** Research and development

**Objective:** To reduce production and distribution cost of fuels, and increase the yield of production processes in order to improve competitiveness.

**Relevant government department:** National Energy Agency

**Description:** The Agency is financing fundamental research into the production and use of alternative motor fuels, with the aim of developing existing and new technology. The current focus is on the production of ethanol as well as the design of a pilot plant for the production of ethanol from forest raw materials in Örnsköldsvik. Projects are also underway in areas such as commercial vehicles powered by biogas, production of biobased methanol and the mixing of diesel oil and ethanol/RME. The annual budget for this initiative is SEK 16 million (CAN\$2.8 million).

**Year of implementation:** 2003 (in place until 2005)

**Sub-sector targeted:** Biomass conversion

**Name of initiative:** Green Certificates to Promote Renewable Electricity Production

**Type of initiative:** Procurement

**Objective:** To create a market for electricity produced from renewable energy.

**Relevant government department:** National Energy Agency

**Description:** In 2003, renewable energy sources electricity certificates will be introduced. All consumers will be obliged to have a certain proportion of their electricity produced by renewable energy sources.

**Year of implementation:** 2003

**Sub-sector targeted:** Bioenergy market development

**Name of initiative:** Consumption Target

**Type of initiative:** Standards and Guidelines

**Objective:** To set a target to guide increased production and consumption over time.

**Relevant government department:** National Energy Agency

**Description:** The initiative aims to increase renewable electricity by 10 TWh between 2003 and 2010. The EU Directive renewable electricity target for Sweden is 60% by 2010, up from 49.1 % in 1997.

**Year of implementation:** not available

**Sub-sector targeted:** Bioenergy market development

Table 2 summarizes the policies in place in Sweden related to bioenergy.



**Table 3. Summary of Policies Related to Bioenergy in Sweden**

<b>Name of Initiative</b>	<b>Type of Initiative</b>	<b>Sub-Sector Targeted</b>
Sustainable Production of Forest Fuels Research Program	Research and development	Biomass availability
Bioenergy and Biological Diversity Research Program	Research and development	Biomass availability
Agriculturally Produced Solid Biofuels	Research and development	Biomass availability
Energy Forest Plantation Grants	Financial incentive	Biomass availability
Energy from Waste	Research and development	Biomass conversion
Ethanol from Forest Raw Materials Research Program	Research and development and demonstration	Biomass conversion
Small-scale Combustion of Biofuels Research Program	Research and development	Biomass conversion
Combustion and Gasification of Solid Biofuels for Combined Heat and Power Production	Research and development	Biomass conversion
Biofuel-fired Combined Heat and Power Investment Grants for New Plants	Financial incentive	Bioenergy market development
Biofuel-fired Combined Heat and Power Investment Grants for Retrofitting Existing Plants	Financial incentive	Bioenergy market development
Pilot Project Tax Relief	Financial incentive	Bioenergy market development
Tax Break for Alternative Fuelled Employee Automobiles	Financial incentive	Bioenergy market development
Alternative Motor Fuels	Research and development	Biomass conversion
Green Certificates to Promote Renewable Electricity Production	Procurement	Bioenergy market development
Consumption Target	Standards and guidelines	Bioenergy market development

Table 3 tallies the number of policies in place in Sweden according to the type of policy and the biomass sub-sector it targets. As the summary below reveals, to promote and manage bioenergy production and consumption in Sweden there is a heavy focus on the use of research and development and financial incentives. Research and development policies focus on biomass availability and conversion while financial incentives are concentrated on facilitating market development opportunities.

**Table 4. Sweden Policy Trend Identification Matrix**

<b>Target</b>	<b>R&amp;D</b>	<b>LNS</b>	<b>PRG</b>	<b>FI</b>	<b>PRC</b>	<b>DEM</b>	<b>INF</b>	<b>STD</b>
Availability	✓ ✓ ✓			✓				
Harvesting and Supply Systems								
Conversion	✓ ✓ ✓ ✓ ✓					✓		
Market Development				✓ ✓ ✓ ✓	✓			✓

R&amp;D: Research and Development

LNS: Loans

PRG: Program Activities

FI: Financial Incentives

PRC: Procurement Programs

DEM: Demonstration Programs

INF: Information and Education Programs

STD: Standards and Guidelines

## 4 Policies in Place in the United States

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**Name of initiative:** Conservation Reserve Program (CRP)

**Type of initiative:** Financial incentive

**Objective:** To allow for the sustainable harvest of biomass for energy production on CRP lands and to expand biomass resources and create a potential income stream for farmers.

**Relevant government department:** Department of Agriculture

**Description:** The CRP program provides rental payments to farmers to keep marginal and highly erodible land out of production. The Conservation Reserve Program allows managed harvesting of biomass on CRP-enrolled lands, consistent with CRP's conservation goals, and with an appropriate reduction in rental payments for any economic benefit received by the farmer, while still providing a net incentive. The Agriculture Appropriations Bill authorized the creation of up to six biomass energy pilot projects on CRP land. Currently, approved projects are underway in Illinois, Iowa, Minnesota, New York, Oklahoma, and Pennsylvania. These projects are experimenting with a variety of energy crops including willows, switchgrass and hybrid poplars.

**Year of implementation:** 1985

**Sub-sector targeted:** Biomass availability

**Name of initiative:** National Biofuels Program — Feedstock Research and Analysis: Integrated Analysis

**Type of initiative:** Research and development

**Objective:** To provide information that bridges the economic sectors that produce biomass resources, the energy sector, and the environmental sector.

**Relevant government department:** Department of Energy

**Description:** This initiative provides consistent and documented data on biomass resources (including a national biomass resources database). A core product of this work is consistent estimates of the price, quantity and quality of existing and potential biomass supplies at county, state and national levels.

**Year of implementation:** 1988 (in 2002 it was incorporated into the Office of the Biomass Program)

**Sub-sector targeted:** Biomass availability

**Name of initiative:** National Biofuels Program — Feedstock Research and Analysis: Sustainability

**Type of initiative:** Department of Energy

**Objective:** To address questions on the sustainability of biomass production raised by environmental organizations, researchers and producers.

**Relevant government department:** Research and development

**Description:** This program conducts studies on biodiversity, habitat impacts and soil and water quality in the context of biomass production. Its current focus is integrating environmental and economic analysis, including developing the underlying data needed to support such integration in assessing the sustainability of collecting corn stover.

**Year of implementation:** 1988 (in 2002 it was incorporated into the Office of the Biomass Program)

**Sub-sector targeted:** Biomass availability

**Name of initiative:** Energy Audit and Renewable Energy Development Program

**Type of initiative:** Financial incentive

**Objective:** To provide seed money to leverage private financing of biomass projects.

**Relevant government department:** Department of Agriculture

**Description:** This is a cost-share grant program to help farmers identify and assess their renewable energy resources and energy efficiency improvement potential. Funds for this program are currently subject to appropriations.

**Year of implementation:** Part of the 2002 Farm Bill

**Sub-sector targeted:** Biomass availability

**Name of initiative:** National Biofuels Program — Feedstock Research and Analysis: Systems Engineering

**Type of initiative:** Research and development

**Objective:** The short-term objective is to improve the cost-competitiveness of biomass energy systems. The overall goal is to develop safe and sustainable supply systems capable of supplying significant biobased industrial development.

**Relevant government department:** Department of Energy

**Description:** The program focuses on collecting, storing and transporting biomass feedstocks. The scope includes the physical and chemical characterization of biomass for the design and operation of handling equipment and the testing and validation of improved or innovative concepts for handling and storing biomass. Current research is focused on efficient handling of crop residue (straw and stover) for biofuels and harvesting and treatment of energy crops (grasses and woody crop) for electricity from biomass.

**Year of implementation:** 1988 (in 2002 it was incorporated into the Office of the Biomass Program)

**Sub-sector targeted:** Biomass conversion

**Name of initiative:** *Biomass Research and Development Act of 2000*

**Type of initiative:** Research and development

**Objective:** To contribute to the goal of tripling the use of bioenergy and biobased-products by 2010.

**Relevant government department:** Department of Energy

**Description:** The *Biomass Research and Development Act of 2000* established a cabinet-level Research and Development Board on Biobased Products and Bioenergy. This board is co-chaired by the Secretaries of Energy and Agriculture and a Technical Advisory Committee composed of industry, academic, agricultural and environmental leaders. The task of the board is to coordinate federal bioenergy and biobased product research, with the goal of tripling the use of bioenergy and biobased products by 2010. The Technical Advisory Committee has completed a “roadmap” for future biomass research, which will establish concrete short- to long-term goals and measures for success. These efforts have been funded through existing Department of Agriculture and Department of Energy authority, as Congress has yet to appropriate any funds for the initiative. The *Biomass Research and Development Act* also specifies funding for future research and development related to biomass. Funding provided for in the Act will be used to support the commercialization of biomass conversion technologies. Total funding is US\$75 million (CAN\$110 million); US\$5 million (CAN\$7 million) for fiscal year 2002 and US\$14 million (CAN\$20.6 million) per year for fiscal years 2003 to 2007. An additional US\$49 million (CAN\$72 million) per year for fiscal years 2002 to 2007 is currently subject to appropriations.

**Year of implementation:** 2000

**Sub-sector targeted:** Biomass conversion

**Name of initiative:** Alcohol Fuels Credit

**Type of initiative:** Financial incentive

**Objective:** To encourage the production of alternative fuels.

**Relevant government department:** Internal Revenue Service

**Description:** Businesses that sell or use alcohol as a fuel may be eligible for an income tax credit. The alcohol fuel credit consists of a straight alcohol credit, an alcohol mixture credit, and a small ethanol producer credit. Alcohols eligible for the credit include methanol and ethanol. This includes methanol produced from methane gas formed in waste disposal sites. Credits range from US\$0.3926 (CAN\$0.5769) to US\$0.60 (CAN\$0.8816) per gallon, depending on the proof and type of alcohol.

**Year of implementation:** First introduced in 1978

**Sub-sector targeted:** Bioenergy market development

**Name of initiative:** Biorefinery Development Grants

**Type of initiative:** Financial incentive

**Objective:** To develop the biorefinery model wherein multiple products are produced at the same facility.

**Relevant government department:** Department of Agriculture

**Description:** This program serves to make funds available to support the development of facilities that convert biomass into several marketable products, including electricity, fuels and chemicals. This program is subject to annual appropriations and was not funded in 2003.

**Year of implementation:** Part of 2002 Farm Bill

**Sub-sector targeted:** Biomass conversion

**Name of initiative:** AgSTAR Program

**Type of initiative:** Information

**Objective:** To increase the use of methane recovery technologies.

**Relevant government department:** Environmental Protection Agency, Department of Agriculture and Department of Energy

**Description:** AgSTAR is a voluntary effort jointly sponsored by the Environmental Protection Agency, the Department of Agriculture and the Department of Energy. The program encourages the use of methane recovery (biogas) technologies at confined animal feeding operations that manage manure as liquids or slurries. Use of such technologies is largely encouraged by the production of the *Industry Directory for On-Farm Biogas Recovery Systems*, which provides information on system designers and developers, and equipment manufacturers and distributors.

**Year of implementation:** 1993

**Sub-sector targeted:** Biomass conversion

**Name of initiative:** Biofuels Conversion Technology Development Program

**Type of initiative:** Research and development (with some information and education)

**Objective:** To establish cost-effective technology for producing liquid transportation fuels from biomass materials. Research is also geared toward promoting the ultimate development of biorefineries able to make as wide a range of products from biomass as do oil refineries from petroleum.

**Relevant government department:** Department of Energy

**Description:** There are three components to the Biofuels Conversion Technology Development Program: Advanced Bioethanol Technology; Renewable Diesel; and Bridging to the Corn Ethanol Industry. The aim of the Advanced Bioethanol Technology component is to develop lignocellulosic biomass-to-ethanol technologies to tap the energy potential of biomass for the transportation sector. Research and development activities are being carried out on acid hydrolysis, enzymatic hydrolysis and biomass gasification and fermentation. The mission of the Renewable Diesel component is to identify, develop and deploy cost-competitive, environmentally acceptable and safe technologies for producing biomass-derived diesel transportation fuels. In addition, this project aims to educate key public officials and the general public about biodiesel as a transportation fuel. The primary focus of the Biofuels Program is the Bridging to the Corn Ethanol Industry component of the program. This aim of this component is to develop technology for producing fuel ethanol from the cellulose and hemicellulose that make up the bulk of plant material. The objective of this work is to commercialize this technology in the near future.

**Year of implementation:** 1988 (in 2002 it was incorporated into the Office of the Biomass Program)

**Sub-sector targeted:** Biomass conversion

**Name of initiative:** Department of Agriculture, Agriculture Research Service — Bioenergy and Energy Alternatives Program

**Type of initiative:** Research and development

**Objective:** This program seeks to create jobs and economic activity in America, reduce the nation's dependence on foreign oil, and improve the environment by developing alternate energy sources and increasing the use of agricultural crops as feedstocks for biofuels.

**Relevant government department:** Department of Agriculture

**Description:** The mission is achieved through research programs on ethanol production, biodiesel conversion technologies, energy alternatives for rural communities and production of energy crops.

**Year of implementation:** The Agriculture Research Service has been in place since 1959

**Sub-sector targeted:** Biomass availability, biomass conversion and bioenergy market developments

**Name of initiative:** Excise Tax Exemption

**Type of initiative:** Financial incentive

**Objective:** To increase consumption of fuels that contain a blend of gasoline and ethanol and thus reduce emissions of greenhouse gases and other pollutants.

**Relevant government department:** Internal Revenue Service

**Description:** A partial fuel tax exemption is available for gasoline and ethanol-blended fuels. The rate of the exemption depends on the relative content of ethanol with a maximum tax reduction of US\$0.0545 (CAN\$0.0801)/gallon of blended fuel where the ethanol content is above 85%. A tax reduction of US\$0/05.4 (CAN\$0.0779 cents)/gallon is available for blended fuel containing 10% ethanol. Reductions of US\$0.0416 (CAN\$0.0611 cents)/gallon and US\$0.0308 (CAN\$0.0452) /gallon are available for fuel containing 7.7% and 5.7% ethanol respectively.

**Year of implementation:** First introduced in 1978

**Sub-sector targeted:** Bioenergy market development

**Name of initiative:** Biodiesel Fuel Education Program

**Type of initiative:** Financial incentive and information

**Objective:** To increase consumer confidence in biodiesel.

**Relevant government department:** Department of Agriculture

**Description:** This is a grant program to educate public and private consumers about the benefits of biodiesel. Total budget is US\$5 million (CAN\$7.4 million) — US\$1 million (CAN\$1.5 million) per year from fiscal year 2003 to 2007.

**Year of implementation:** 2003

**Sub-sector targeted:** Bioenergy market development

**Name of initiative:** Renewable Energy Systems and Energy Efficiency Improvements

**Type of initiative:** Financial incentive and loans

**Objective:** To provide seed money to leverage private financing of biomass projects.

**Relevant government department:** Department of Agriculture

**Description:** These grant and loan programs serve to assist farmers, ranchers and rural small business in purchasing renewable energy systems and in making energy efficiency improvements. Grants can be issued for up to 25% of a proposed project, with grants and loans combined not to exceed 50% of project costs. Priority funding is given to farmers who have completed energy audits and resource assessments. US\$23 million (CAN\$34 million) per year is available for this program from fiscal year 2003 to 2007.

**Year of implementation:** 2003

**Sub-sector targeted:** Bioenergy market development

**Name of initiative:** Commodity Credit Corporation (CCC) Bioenergy Program

**Type of initiative:** Financial incentive

**Objective:** To provide partial compensation to producers of ethanol and biodiesel for the purchase of commodities used to expand existing productions.

**Relevant government department:** Department of Agriculture

**Description:** The CCC is the financing organization for the Department of Agriculture's commodity programs. Congress established the bioenergy program in 2000, using appropriated funds. The budget for this program is US\$204 million (CAN\$300 million) total for fiscal years 2003 to 2006. To date, this program has largely been used to reimburse ethanol producers for corn purchases, although cellulosic

crops are also listed as an eligible commodity under the program. Biodiesel producers are also eligible to receive funds under this program.

**Year of implementation:** Authorization to continue this program was granted in 2003

**Sub-sector targeted:** Bioenergy market development

**Name of initiative:** Value Added Grant Program

**Type of initiative:** Financial incentive

**Objective:** To provide important seed money to leverage private financing for biomass projects.

**Relevant government department:** Department of Agriculture

**Description:** Grants are available to help independent agricultural producers enter into value-added activities. Value-added includes using any agricultural product or commodity to produce renewable energy on a farm or ranch. The maximum award per grant is US\$500,000 (CAN\$735,500). To maximize the distribution of program benefits, smaller grant requests under US\$500,000 (CAN\$735,500) receive priority. Priority is also given to projects producing energy from biomass or demonstrating profitable use of innovative technologies. The budget is US\$33 million (CAN\$49 million) for fiscal year 2002

**Year of implementation:** The 2002 Farm Bill modified the Value Added Grant Program to clarify that farm- or ranch-based renewable energy projects, including biofuel projects, qualify as value-added under this program.

**Sub-sector targeted:** Bioenergy market development

**Name of initiative:** Landfill Methane Outreach Program (LMOP)

**Type of initiative:** Information

**Objective:** To facilitate the use of landfill gas as a renewable energy source.

**Relevant government department:** Environmental Protection Agency

**Description:** LMOP is a voluntary assistance and partnership program that promotes the use of landfill gas as a renewable energy source. LMOP does this by educating local government and communities about the benefits of landfill gas recovery and building partnerships between state agencies, industry, energy service providers, local communities, and other stakeholders interested in developing this resource in their community.

**Year of implementation:** 1994

**Sub-sector targeted:** Bioenergy market development

**Name of initiative:** Deductions for Clean Fuel Vehicle and Refuelling Property

**Type of initiative:** Financial incentive

**Objective:** To increase the number of clean fuel vehicles in use in the United States.

**Relevant government department:** Internal Revenue Service

**Description:** Income tax deductions for qualified clean-fuel vehicle property, qualified clean-fuel vehicle refuelling property and incremental costs associated with the purchase of vehicles propelled at least partially by a clean-burning fuel. Light-duty vehicles are eligible for a maximum deduction of US\$2,000 (CAN\$3,141); trucks or vans with gross weight rating greater than 10,000 pounds but not greater than 26,000 pounds are eligible for up to US\$5,000 (CAN\$7,852); and trucks and vans exceeding 26,000 pounds, along with buses with a seating capacity of at least 20 passengers, may qualify for a maximum deduction of US\$50,000 (CAN\$78,516). Clean-fuel refuelling property is eligible for a deduction of up to US\$100,000 (CAN\$157,032). Clean-burning fuels include natural gas, liquefied natural gas, liquefied petroleum gas, hydrogen, electricity and any other fuel that is at least 85% methanol, ethanol, or any other alcohol or ether.

**Year of implementation:** 2001

**Sub-sector targeted:** Bioenergy market development

**Name of initiative:** Renewable Energy Production Tax Credit

**Type of initiative:** Financial incentive

**Objective:** To foster electricity generation from wind and biomass facilities in the United States.

**Relevant government department:** Internal Revenue Service

**Description:** Private entities subject to taxation (corporations, small businesses and individuals) that generate electricity from wind and biomass facilities and sell this electricity to an unrelated party are eligible to receive a renewable energy production tax credit (PTC). Initially, this policy was only applicable to closed-loop biomass facilities. A closed-loop facility is a biomass power facility that utilizes biomass grown exclusively for energy production. Thus, the tax credit was not available for a taxpayer cutting standing timber to produce electricity, nor was it available for projects using residues from agricultural or forestry operations where the residues are the result of some non-energy-related activity. In 2002 this production tax credit was expanded to include open-loop biomass. In 1999, the PTC was made available to poultry waste facilities that generate and sell electricity and that were placed in service after 1999. The PTC was initially set at US\$0.015 (CAN\$0.022)/kWh and is adjusted annually for inflation. The PTC for 2001 was US\$0.017 (CAN\$0.025)/kWh.

**Year of implementation:** 1992

**Sub-sector targeted:** Bioenergy market development

**Name of initiative:** Renewable Energy Production Incentive (REPI)

**Type of initiative:** Financial incentive

**Objective:** To promote increases in the generation and utilization of electricity from renewable energy sources and to further the advances of renewable energy technologies.

**Relevant government department:** Managed by the Department of Energy and administered by the Internal Revenue Service

**Description:** This is an incentive to produce and sell electricity from qualifying renewable energy generation facilities. Eligible electric production facilities are those owned by state and local government entities (such as municipal utilities) and not-for-profit electric co-operatives that started operations between October 1, 1993 and September 30, 2003. Qualifying facilities are eligible for annual incentive payments of US\$0.015 (CAN\$0.022) per kWh (1993 dollars, indexed for inflation) for the first ten-year period of their operation, subject to the availability of annual appropriations in each federal fiscal year of operation. Qualifying facilities must use solar, wind, geothermal (with certain restrictions) or biomass (except for municipal solid waste combustion) generation technologies.

**Year of implementation:** 1992

**Sub-sector targeted:** Bioenergy market development

**Name of initiative:** National Biofuels Program — Outreach and Technology Transfer

**Type of initiative:** Information and demonstration

**Objective:** To increase the production and use of bioenergy resources.

**Relevant government department:** Department of Energy

**Description:** This program is carried out by the Regional Biomass Energy Program (RBEP), which was established in 1983. This program seeks ways to facilitate expanded use of biomass resources for the production of renewable transportation fuels and electric power. It has also supported bioenergy applications in the industrial and building sectors. The program helps advance the use of biomass feedstocks and technology market niches, disseminate information and fund demonstration projects that lead to the development of new industries and jobs.

**Year of implementation:** 1983

**Sub-sector targeted:** Bioenergy market development

**Name of initiative:** Biofuels Procurement Program

**Type of initiative:** Procurement

**Objective:** To increase the sale of biobased products and bioenergy. The United States federal government is the world's largest single purchaser of goods and services.

**Relevant government department:** Department of Agriculture



**Description:** The Department of Agriculture will use biodiesel and ethanol in their fleet vehicles where practical and reasonable in cost. In 2000, the Department of Agriculture committed to the acquisition and consumption of at least 20,000 gallons of biodiesel. Several pilot fuelling stations have already been opened in the United States. In 2000, federal agencies owned over 20,000 ethanol-capable vehicles. In addition, the Beltsville Center of the Agriculture Research Service plans to heat all of its buildings with biodiesel.

**Year of implementation:** 1999

**Sub-sector targeted:** Bioenergy market development

**Name of initiative:** Public Utilities Regulatory Act (PURPA)

**Type of initiative:** Standards and guidelines

**Objective:** To encourage the development of a small-scale electric power plants, especially those fuelled by renewable resources

**Relevant government department:** Federal Energy Regulatory Commission

**Description:** This program requires regulated utilities to interconnect with and purchase electricity produced by a “qualifying facility” (QF). A QF includes power producers who use renewable sources of energy such as biomass, geothermal, hydro-electricity, solar, and wind, or who are cogenerators producing both heat and electricity using any type of fuel. PURPA requires utilities to purchase electricity from these power producers at a rate approved by a state utility regulatory agency, under federal guidelines.

**Year of implementation:** 1978

**Sub-sector targeted:** Bioenergy market development

**Name of initiative:** Consumption Target

**Type of initiative:** Standards and guidelines

**Objective:** To set a target to guide increased production and consumption over time.

**Relevant government department:** Department of Energy

**Description:** The program aims to triple the use of biobased products and bioenergy by 2010 over 2000 levels and to realize a ten-fold increase by 2020.

**Year of implementation:** Not available

**Sub-sector targeted:** Bioenergy market development

Table 4 summarizes the policies in place in the United States related to the production and consumption of bioenergy.

**Table 5. Summary of Policies Related to Bioenergy in the United States**

<b>Name of Initiative</b>	<b>Type of Initiative</b>	<b>Sub-Sector Targeted</b>
Conservation Reserve Program	Financial incentive	Biomass availability
National Biofuels Program — Feedstock Research and Analysis: Integrated Analysis	Research and development	Biomass availability
National Biofuels Program — Feedstock Research and Analysis: Sustainability	Research and development	Biomass availability
Energy Audit and Renewable Energy Development Program	Financial incentive	Biomass availability
National Biofuels Program — Feedstock Research and Analysis: Systems Engineering	Research and development	Biomass conversion
<i>Biomass Research and Development Act</i>	Research and development	Biomass conversion
Alcohol Fuels Credit	Financial incentive	Bioenergy market development
Biorefinery Development Grants	Financial incentive	Biomass conversion
AgSTAR Program	Information	Biomass conversion
Biofuels Conversion Technology Development Program	Research and development	Biomass conversion
Agriculture Research Services — Bioenergy and Energy Alternatives Program	Research and development	Biomass availability, biomass conversion and bioenergy market development
Excise Tax Exemption	Financial incentive	Bioenergy market development
Biodiesel Fuel Education Program	Financial incentive and information	Bioenergy market development
Renewable Energy Systems and Energy Efficiency Improvements	Financial incentive and loans	Bioenergy market development
Commodity Credit Corporation Bioenergy Program	Financial incentive	Bioenergy market development
Value Added Grant Program	Financial incentive	Bioenergy market development
Landfill Methane Outreach Program	Information	Bioenergy market development
Deductions for Clean Fuel Vehicles and Refuelling Property	Financial incentive	Bioenergy market development
Renewable Energy Production Tax Credit	Financial incentive	Bioenergy market development
Renewable Energy Production Incentive	Financial incentive	Bioenergy market development
National Biofuels Program — Outreach and Technology Transfer	Information and demonstration	Bioenergy market development
Biofuels Procurement Program	Procurement	Bioenergy market development
Public Utilities Regulatory Act	Standards and guidelines	Bioenergy market development
Consumption Target	Standards and guidelines	Bioenergy market development

Table 5 tallies the number of policies in place in the United States according to the type of policy and the sub-sector it targets. As was the case in Sweden, in the United States there is a heavy focus on the use of research and development and financial incentives. Within research and development, policies have been mainly targeted at biomass availability and conversion, while financial incentives have mainly been geared toward market developments. The United States has also implemented a number of information and education programs related to bioenergy.

**Table 6. United States Policy Trend Identification Matrix**

<b>Target</b>	<b>R&amp;D</b>	<b>LNS</b>	<b>PRG</b>	<b>FI</b>	<b>PRC</b>	<b>DEM</b>	<b>INF</b>	<b>STD</b>
Availability	✓ ✓ ✓			✓ ✓				
Harvesting and Supply Systems	✓							
Conversion	✓ ✓ ✓ ✓			✓		✓		
Market Developments	✓	✓		✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓	✓	✓	✓ ✓ ✓	✓ ✓

R&D: Research and Development

LNS: Loans

PRG: Program Activities

FI: Financial Incentives

PRC: Procurement Programs

DEM: Demonstration Programs

INF: Information and Education Programs

STD: Standards and Guidelines

## 5 Policies in Place in Finland

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**Name of initiative:** Forest Improvement Grants

**Type of initiative:** Financial incentive

**Objective:** To increase production and harvesting of energy wood.

**Relevant government department:** Ministry of Agriculture and Forestry

**Description:** The Forest Program provides subsidies for tending, harvesting and transportation of energy wood produced from young stands. The program covers 130,000 to 145,000 hectares of land yearly. The grant for tending wood is EUR 166 (CAN\$261.07)/ha. The grant for transportation is EUR 6.73 (CAN\$10.70)/m<sup>3</sup> (solid) (EUR 3.37 (CAN\$5.30) /MWh). Chipping energy wood harvested from young stands receives a subsidy of EUR 1.68 (CAN\$2.60) /m<sup>3</sup> (loose) (EUR 1.87 (CAN\$2.90) /MWh). The annual budget for this program is EUR 25 million (CAN\$40 million). In 2002, EUR 22,678,644 (CAN\$36,056,685) was spent on tending grants; EUR 2,585,645 (CAN\$4,110,908) was spent on transportation grants; and EUR 408,625 (CAN\$649,671) was spent on chipping grants. As part of this program, funds are also available for organizations that help forest owners to submit applications for the above grants. This component of the program received EUR 4,110,503 (CAN\$653,527) in 2002.

**Year of implementation:** 1998

**Sub-sector targeted:** Biomass availability and biomass harvesting and supply systems

**Name of initiative:** National Wood Energy Technology Program

**Type of initiative:** Program activity

**Objective:** The aim of the program is to enhance efficiency in the production chain in order to produce fuel for various user groups in the most competitive way.

**Relevant government department:** National Technology Agency (Tekes)

**Description:** This program focuses on developing the production technology and improving the quality of forest chips from logging residues and small-sized trees. The program concentrates on developing production, logistics, quality control and storage of forest chips, bark, sawdust and other process residues suitable as fuel for the forest industry. The program's total budget for 1999 to 2003 is about EUR 42 million (CAN\$67 million).

**Year of implementation:** 1999

**Sub-sector targeted:** Biomass harvesting and supply systems

**Name of initiative:** Research and Development for Bioenergy Technology

**Type of initiative:** Research and development

**Objective:** To increase the use of economically profitable and environmentally sound bioenergy.

**Relevant government department:** Ministry of Trade and Industry

**Description:** This research and development expenditure on bioenergy technology is channelled through the research program for bioenergy. Research and development projects are aimed at developing new economically competitive biomass fuels, new equipment and methods of production, biomass handling and biomass uses. The budget for this program is approximately FIM 60 million (CAN\$16 million) per year.

**Year of implementation:** 1996

**Sub-sector targeted:** Biomass harvesting and supply systems and biomass conversion

**Name of initiative:** Investment Aid

**Type of initiative:** Financial incentive

**Objective:** To promote investment in heat and power generation, renewable energy sources and energy efficiency.

**Relevant government department:** Ministry of Trade and Industry

**Description:** This program offers investment aid for applicants planning renewable energy investments. Between 1999 and 2003, the maximum level of subsidy for wind power was 40% of accepted costs. For other renewable energy investments, including biomass investments, the subsidy was 30% of accepted costs. The Ministry of Trade and Industry has reserved the right to define accepted costs, although generally they refer to total investment cost. In the past, the largest investment subsidies have been granted for bioenergy.

**Year of implementation:** 1990

**Sub-sector targeted:** Bioenergy market development

**Name of initiative:** Exemption from Carbon Tax

**Type of initiative:** Financial incentive

**Objective:** To encourage use of renewable energy sources.

**Relevant government department:** Ministry of Finance

**Description:** Finland was the first country to implement a carbon base tax in 1990. Renewable energy sources (for heat and electricity), including biomass, are completely exempt from the national carbon tax. In 1998 the CO<sub>2</sub> tax was FIM 80 (CAN\$21)/tonne of CO<sub>2</sub>.

**Year of implementation:** 1990

**Sub-sector targeted:** Bioenergy market development

**Name of initiative:** Subsidy for Renewable Electricity Production

**Type of initiative:** Financial incentive

**Objective:** To improve the competitiveness of renewables in electricity production (since all fuels are exempted from tax in electricity production).

**Relevant government department:** Ministry of Finance

**Description:** Since January 1997, a price subsidy was granted for electricity generated by wind power, biofuels and peat. The policy was revised in 1998 and, since then, the subsidy rates have increased. The subsidy varies according to the type of renewable energy source. For forest chips it is 0.69 FIM (CAN\$0.18)/kWh; for other wood and wood based fuels it is 0.42 FIM (CAN\$0.11)/kWh; for biogas it is 0.42 FIM (CAN\$0.11)/kWh; and for solid recovered fuels it is 0.25 FIM (CAN\$0.07)/kWh.

**Year of implementation:** First implemented in 1997 and revised in 1998

**Sub-sector targeted:** Bioenergy market development

**Name of initiative:** Subsidies for Harvesting Wood Energy

**Type of initiative:** Financial incentive

**Objective:** To increase the availability of energy wood from young stands.

**Relevant government department:** Ministry of Agriculture and Forestry

**Description:** Subsidies are granted for harvesting wood energy. Approximately 12 to 15 FIM (CAN\$3.15 to \$3.95)/MWh is available to support harvesting of fuel wood. A total of 120 million FIM (CAN\$3.15) was made available for this program from 1998 to 2002.

**Year of implementation:** 1998

**Sub-sector targeted:** Biomass harvesting and supply systems

**Name of initiative:** Action Plan for Renewable Energy Sources

**Type of initiative:** Standards and guidelines

**Objective:** To increase the use of renewable energy by 50% by the year 2010 and 100% by the year 2025 using 1995 as the base year.

**Relevant government department:** Ministry of Trade and Industry

**Description:** The Action Plan for Renewable Energy Sources was completed in 1999. The aim of this plan is to make energy produced by renewable energy sources, especially the use of wood for energy and wind power, competitive on the open market. The Action Plan has the objective of increasing the use of renewable energy sources by 2010 by 50% (3 Mtoe), using 1995 as the base year. Ninety percent of this

increase is expected to consist of bioenergy. For electricity using renewable energies, the target is to increase the output by 50% as well. In 2001 a total of EUR 21 million (CAN\$33 million) of public funding support was provided to the biomass industry as part of the National Action Plan.

**Year of implementation:** 1999

**Sub-sector targeted:** Bioenergy market development

Table 6 summarizes the policies in place in Finland related to bioenergy.

**Table 7. Policies Related to Bioenergy in Finland, Summary**

Name of Initiative	Type of Initiative	Sub-Sector Targeted
Forest Improvement Grants	Financial incentive	Biomass availability and biomass harvesting and supply systems
National Wood Energy Technology Program	Program activity	Biomass harvesting and supply systems
Research and Development for Bioenergy Technology	Research and development	Biomass harvesting and supply systems and biomass conversion
Investment Aid	Financial incentive	Bioenergy market development
Exemption from Carbon Tax	Financial incentive	Bioenergy market development
Subsidy for Renewable Electricity Production	Financial incentive	Bioenergy market development
Subsidies for Harvesting Wood Energy	Financial incentive	Biomass harvesting and supply systems
Action Plan for Renewable Energy Sources	Standards and guidelines	Bioenergy market development

Table 7 tallies the policies presented above according to the sub-sector targeted and the type of policy employed. The tally shows the strong focus on financial incentives in Finland. Financial incentives are targeted at all biomass sub-sectors but especially market development. Research and development efforts are focused on harvesting and supply systems and biomass conversion.

**Table 8. Finland Policy Trend Identification Matrix**

Target	R&D	LNS	PRG	FI	PRC	DEM	INF	STD
Availability				✓				
Harvesting and Supply Systems	✓		✓	✓ ✓				
Conversion	✓							
Market Development				✓ ✓ ✓				✓

R&D: Research and Development

LNS: Loans

PRG: Program Activities

FI: Financial Incentives

PRC: Procurement Programs

DEM: Demonstration Programs

INF: Information and Education Programs

STD: Standards and Guidelines

## 6 Policies in Place in the United Kingdom

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**Name of initiative:** Government Industry Forum

**Type of initiative:** Program activity

**Objective:** To provide strategic advice to government and industry on the development of non-food uses of crops.

**Relevant government department:** Department for Environment, Food and Rural Affairs

**Description:** The forum links industry and agriculture and evaluates the opportunities for non-food crops used in the United Kingdom and provides strategic advice on how these can be used to the benefit of British industry and agriculture. The forum meets four times per year to discuss technological and market developments for non-food uses of crops and to make recommendations on policy affecting non-food uses of crops and on research and development priorities.

**Year of implementation:** 2001

**Sub-sector targeted:** Biomass availability, biomass harvesting and supply systems, biomass conversion and bioenergy market developments.

**Name of initiative:** Energy Crops Scheme

**Type of initiative:** Financial incentive

**Objective:** To increase the national supply of energy crops.

**Relevant government department:** Department for Environment, Food and Rural Affairs

**Description:** The Energy Crops Scheme provides grants for establishing short rotation energy crops. Payments of between GBP 920 (CAN\$213)/ha and GBP 1,600 (CAN\$3,708)/ha are available for establishing crops such as coppiced willow and miscanthus. The program will also pay up to 50% of the costs of setting up producer groups. To be eligible, the crops must be produced for power generation, combined heat and power, or heat, and there must be an agreement to supply the harvested crops to a local end-user. The annual budget for this program is GBP 29 million (CAN\$67 million).

**Year of implementation:** 2000

**Sub-sector targeted:** Biomass availability

**Name of initiative:** Farm Woodland Premium Scheme

**Type of initiative:** Financial incentive

**Objective:** To encourage the planting of new woods on land currently in productive agriculture, thereby enhancing the farmed landscape and environment.

**Relevant government department:** Ministry of Agriculture, Fisheries and Food

**Description:** This is open to farmers throughout England. Annual payments ranging from GBP 60 (CAN\$139)/ha to GBP 300 (CAN\$695)/ha are available depending on the type of land to be planted. These payments are in addition to the full range of planting grants payable by the Forestry Commission under the Woodland Grant Scheme described below.

**Year of implementation:** 1992

**Sub-sector targeted:** Biomass availability

**Name of initiative:** Woodland Grant Scheme

**Type of initiative:** Financial incentive

**Objective:** To encourage the creation of new woodlands on farms by offering annual payments to compensate for agricultural income forgone.

**Relevant government department:** Forest Commission

**Description:** Through this program, grants are provided to create new woodlands in England. The grant for conifers is GBP 700 (CAN\$1,622)/ha, rising to GBP 1,050 (CAN\$2,433)/ha for broadleaved species in woods larger than 10 ha and GBP 1,350 (CAN\$3,128)/ha for broadleaved species in woods less than 10 ha. These funds are paid in two instalments, 70% after planting and 30% 5 years later. Restocking

grants of GBP 325 (CAN\$753)/ha for conifers and GBP 525 (CAN\$1,216)/ha for broadleaves are paid in one instalment after planting. An additional Better Land Supplement of GBP 600 (CAN\$1,390)/ha is payable for planting of conifers or broadleaves on arable land or other cropped land.

**Year of implementation:** Current phase has been in place since 1994 (previous phases ran from 1988 to 1991 and 1991 to 1994)

**Sub-sector targeted:** Biomass availability

**Name of initiative:** Bioenergy Infrastructure Scheme

**Type of initiative:** Financial incentive

**Objective:** To help establish supply chains from field to factory.

**Relevant government department:** Department for Environment, Food and Rural Affairs

**Description:** This scheme will help deploy the supply chain required to harvest, store and supply energy crops and forestry woodfuel to energy end-users. Grants are available to assist 1) setting up of producer groups to supply biomass to energy end-users; or 2) new businesses or existing businesses to diversify into supplying biomass to energy end-uses. The budget for this program is GBP 3.5 million (CAN\$8 million).

**Year of implementation:** Expected to be in place in spring 2003

**Sub-sector targeted:** Biomass harvesting and supply systems

**Name of initiative:** Renewables Obligation

**Type of initiative:** Standards and guidelines

**Objective:** To increase the share of electricity derived from renewable sources to 10% in 2010.

**Relevant government department:** Department of Trade and Industry

**Description:** The Renewables Obligation requires electricity suppliers to derive a specified proportion of the electricity they supply to their customers from renewable sources. A price cap restricts the cost of electricity for consumers. The obligation applies to all licensed electricity suppliers in England and Wales. The level of obligation will gradually increase so that in 2010 10% of the sales from all electricity suppliers should come from a renewable energy source. The current contribution of renewables is 2.5% of total sales.

**Year of implementation:** 2000

**Sub-sector targeted:** Bioenergy market development

**Name of initiative:** Biodiesel and Bioethanol Fuel Tax Reduction

**Type of initiative:** Financial incentive

**Objective:** To increase consumption of biodiesel and bioethanol in the United Kingdom.

**Relevant government department:** HM Customs and Excise

**Description:** A new duty on biodiesel of 25.82 pence per litre (ppl) (CAN\$0.58/L) was introduced in the 2002 budget. It is a cut of 20 ppl (CAN\$0.45/L) compared to ultra-low sulphur diesel. The same reduction is proposed for bioethanol. This reduction is currently subject to EU agreement.

**Year of implementation:** 2002

**Sub-sector targeted:** Bioenergy market development

**Name of initiative:** Climate Change Levy Exemption

**Type of initiative:** Financial incentive

**Objective:** To provide incentive to increase energy efficiency and renewable energy consumption.

**Relevant government department:** Department of Trade and Industry

**Description:** The climate change levy is an energy tax (on electricity and gas) placed on business energy users, including industry, commerce and public sector entities. The tax is 0.43 p/kWh (CAN\$0.097/kWh). Business energy users can qualify for an exemption from the levy by switching their energy supply to renewable energy (for example, biomass). Exemption from the levy is conditional upon proving that the



electricity purchased was produced by eligible generators and providing “Levy Exemption Certificates” to prove that the production took place.

**Year of implementation:** 2001

**Sub-sector targeted:** Bioenergy market development

**Name of initiative:** Community and Household Capital Grant Scheme

**Type of initiative:** Financial incentive

**Objective:** To facilitate deployment of renewable energy technologies at the household or building level.

**Relevant government department:** Department of Trade and Investment

**Description:** Community and household capital grants are available for renewables deployed at the level of the households or building/land owned by non-profit organizations with strong community interests. For households, the amount of grant is dependent upon the technology installed. For community grants, the size of the grant is the lower of 50% of installed costs or 100,000 pounds (CAN\$231,740) regardless of the technology employed. GBP 10 million (CAN\$23,174,000) has been earmarked for this scheme.

**Year of implementation:** 2001

**Sub-sector targeted:** Bioenergy market development

**Name of initiative:** Bioenergy Capital Grant Scheme

**Type of initiative:** Financial incentive

**Objective:** To promote the efficient use of biomass for energy, and in particular the use of energy crops, by simulating the early deployment of biomass-fuelled heat and electricity generation projects.

**Relevant government department:** Department of Trade and Investment with support from the New Opportunities Fund and the Department of Environment, Food and Rural Affairs

**Description:** This program is aimed at commercial producers of energy. Under this scheme, capital grants towards the cost of equipment in complete working installations are available. Grants are likely to be 40% of eligible costs. The total annual funding available for this scheme is at least GBP 66 million (CAN\$153,000).

**Year of implementation:** 1998

**Sub-sector targeted:** Bioenergy market development

**Name of initiative:** Community Renewables Initiative

**Type of initiative:** Financial incentive

**Objective:** To help groups and individuals realize that renewable energy can form part of the regeneration of places including rural areas, market towns, farmed landscapes, villages and cities.

**Relevant government department:** The Countryside Agency

**Description:** The initiative promotes environmentally sensitive developments of solar roofs, biomass and wood heat schemes, farm waste schemes, and wind turbines in places like schools, hospitals, offices, shops, farms, community halls and housing developments.

**Year of implementation:** 2002

**Sub-sector targeted:** Bioenergy market development

**Name of initiative:** Green Tariffs

**Type of initiative:** Financial incentive

**Objective:** To increase the supply of renewable energy.

**Relevant government department:** Office of Gas and Electricity Markets

**Description:** There are two types of green pricing schemes in the United Kingdom. Consumers can subscribe to green energy through existing plants. Under this scheme, the number of subscriptions must equal the amount of green energy bought by suppliers. The second type of green pricing scheme is a fund program; consumers can donate to special funds to which suppliers have similarly pledged financial contributions. There is then a requirement for suppliers to invest in renewable energy capacity within five years.

**Year of implementation:** 1998

**Sub-sector targeted:** Bioenergy market development

Table 8 summarizes the policies in place in the United Kingdom related to bioenergy.

**Table 9. Summary of Policies Related to Bioenergy in the United Kingdom**

Name of Initiative	Type of Initiative	Sub-Sector Targeted
Government Industry Forum	Program activity	Biomass availability, biomass harvesting and supply systems, biomass conversion and bioenergy market development
Energy Crops Scheme	Financial incentive	Biomass availability
Farm Woodland Premium Scheme	Financial incentive	Biomass availability
Woodland Grant Scheme	Financial incentive	Biomass availability
Bioenergy Infrastructure Scheme	Financial incentive	Biomass harvesting and supply systems
Renewables Obligation	Standards and guidelines	Bioenergy market development
Biodiesel and Bioethanol Fuel Tax Reduction	Financial incentive	Bioenergy market development
Climate Change Levy Exemption	Financial incentive	Bioenergy market development
Community and Household Capital Grant Scheme	Financial incentive	Bioenergy market development
Bioenergy Capital Grant Scheme	Financial incentive	Bioenergy market development
Community Renewables Initiative	Financial incentive	Bioenergy market development
Green Tariffs	Financial incentive	Bioenergy market development

Table 9 tallies the policies in place in the United Kingdom according to the sub-sector targeted and the type of policy employed. As was the case with Finland, the United Kingdom government has focused on the use of financial incentives relative to other policy types. Financial incentives have especially been geared towards biomass availability and bioenergy market development. The main program activity of the United Kingdom, the Government Industry Forum, touches on all sub-sectors of biomass.

**Table 10. United Kingdom Policy Trend Identification Matrix**

Target	R&D	LNS	PRG	FI	PRC	DEM	INF	STD
Availability			✓	✓ ✓ ✓				
Harvesting and Supply Systems			✓	✓				
Conversion			✓					
Market development			✓	✓ ✓ ✓ ✓ ✓ ✓				✓

R&D: Research and Development

LNS: Loans

PRG: Program Activities

FI: Financial Incentives

PRC: Procurement Programs

DEM: Demonstration Programs

INF: Information and Education Programs

STD: Standards and Guidelines

## 7 Policies in Place in Germany

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**Name of initiative:** DtA Repayable Loans

**Type of initiative:** Loans

**Objective:** To incent projects that will have a positive effect on the environment.

**Relevant government department:** Deutsche Ausgleichsbank (DtA)

**Description:** The Deutsche Ausgleichsbank (DtA), a public bank, grants low-interest loans to specified projects related to the environment and energy. Available funds can be used to finance investments that have a positive effect on the environment. This includes the building of power plants or heating systems using regenerative energy sources, such as solid biomass or biogas. Applicants must be commercial companies or entrepreneurs. Between 1990 and 1997 biomass projects received DM 268 million (CAN\$217 million).

**Year of implementation:** The program in its current form was implemented in 1992 (this program is the successor to an earlier similar program)

**Sub-sector targeted:** Biomass conversion

**Name of initiative:** Research and Development Funds

**Type of initiative:** Research and development

**Objective:** To develop and improve technologies that will contribute towards long-term sustainable decreases in CO<sub>2</sub> emissions.

**Relevant government department:** Ministry of Consumer Protection, Food and Agriculture<sup>11</sup>

**Description:** The Federal Ministry provides DM 50 million (CAN\$41 million) per year for research and development and demonstration projects in the agricultural non-food sector. Experience during the past years has shown that between 10% and 20% of this budget is assigned to the utilization of biomass. This includes projects to improve combustion technologies, analyze market potential and construct new heating or combined heat-power plants. Plants receive a subsidy of up to 60% of investment costs. Research enterprises receive up to 60% of funding costs (universities get up to 100%).

**Year of implementation:** 1985

**Sub-sector targeted:** Biomass conversion

**Name of initiative:** Renewable Energy Law (REL)

**Type of initiative:** Standards and guidelines

**Objective:** The overall objective of the law is to contribute towards doubling the share of renewable energy in the electricity market from 5% to 10% by 2010 in line with targets set in the European Commission's 2001 Renewable Energy Directive (1997 Renewable Energy White Paper).

**Relevant government department:** Ministry of Environment, Nature Conservation and Nuclear Safety

**Description:** The REL requires a portion of electricity to be derived from renewable sources. The law allows for fixed remuneration fees for renewable sources. The assistance gives investors needed planning security over a sufficiently long period of time.

**Year of implementation:** 2000

**Sub-sector targeted:** Bioenergy market development

**Name of initiative:** Biomass Ordinance

**Type of initiative:** Financial incentive

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<sup>11</sup> Research within the area of renewable energies in a wider sense may also be supported by the following institutions: Federal Ministry of Economics and Labour (former Ministry of Economics and Technology), Federal Ministry of Education and Research, and Federal Environmental Ministry. Research is also supported at the state (Bundesland) level.

**Objective:** To contribute to sustainable development of the energy supply in the interests of climate and environmental protection.

**Relevant government department:** Ministry of Environment, Nature Conservation and Nuclear Safety

**Description:** The Biomass Ordinance defines biomass in the framework of the Renewable Energy Law (above). It provides a range of compensation for biomass-generated electricity depending on the plant's installed capacity. For biomass, the tariff ranges from DM 0.17 (CAN\$0.14)/kWh for the large units (between 5 and 20 MW), to DM 0.18 (CAN\$0.16)/kWh for smaller units and DM 0.20 (CAN\$0.14)/kWh for the smallest installations (up to 500 kW).

**Year of implementation:** 2001

**Sub-sector targeted:** Bioenergy market development

**Name of initiative:** Excise Tax Exemption

**Type of initiative:** Financial incentive

**Objective:** Broad market introduction of fuels from biomass.

**Relevant government department:** Ministry of Finance

**Description:** The German government exempts rapeseed methyl ester (RME) sold in 250 fuelling stations around the country from the federal petroleum tax. In June 2002, the Federal Council of Germany decided to establish overall tax exemptions for various kinds of biofuels for use in motor vehicles (beyond RME). A proposal to provide exemptions to other kinds of biofuels is currently waiting European Commission approval.

**Year of implementation:** 2002 for the RME exemption (in place until 2008)

**Sub-sector targeted:** Bioenergy market development

**Name of initiative:** Market Incentive Program

**Type of initiative:** Financial incentive

**Objective:** To increase the share of renewables used in the heat market.

**Relevant government department:** Ministry of Economics and Technology

**Description:** This is the central financial support program at the federal level in Germany. The market incentive program focuses assistance on solar collectors and biomass for hot water preparation and space heating as well as biomass for combined heat and power and biogas plants up to 70 kW. The Market Incentive Program provides 20% investment subsidy on average. EUR 602 million (CAN\$954 million) have been allotted for this program up to the year 2004.

**Year of implementation:** 1999

**Sub-sector targeted:** Bioenergy market development

**Name of initiative:** Ecological Tax Reform Policy

**Type of initiative:** Financial incentive

**Objective:** To increase the cost of energy consumption and, at the same time, decrease additional labour costs.

**Relevant government department:** Ministry of Finance

**Description:** This policy included the introduction of a new electricity tax and increased taxes on motor fuels, fuel oil and natural gas. The regulation includes reduced taxes for energy intensive industries and public transport. Tax exemptions are granted for the utilization of biofuels and for heat production from renewable energy sources. Electricity from renewable energy generation is subject to taxation. To compensate, a portion of the revenue from the ecological taxes is earmarked for the market incentive program.

**Year of implementation:** 1999

**Sub-sector targeted:** Bioenergy market development

Table 10 summarizes the policies in place in Germany related to bioenergy.

**Table 11. Summary of Policies Related to Bioenergy in Germany**

Name of Initiative	Type of Initiative	Sub-Sector Targeted
DtA Repayable Loans	Loans	Biomass conversion
Research and Development Funds	Research and development	Biomass conversion
Renewable Energy Law	Standards and guidelines	Bioenergy market development
Biomass Ordinance	Financial incentive	Bioenergy market development
Excise Tax Exemption	Financial incentive	Bioenergy market development
Market Incentive Program	Financial incentive	Bioenergy market development
Ecological Tax Reform Policy	Financial incentive	Bioenergy market development

The table below tallies the policies in place in Germany according to the type of policy in place and the sub-sector targeted. The table reveals the strong reliance on financial incentives in Germany, especially related to bioenergy market development.

**Table 12. Germany Policy Trend Identification Matrix**

Target	R&D	LNS	PRG	FI	PRC	DEM	INF	STD
Availability								
Harvesting and Supply Systems								
Conversion	✓	✓						
Market Opportunity				✓ ✓ ✓				✓

R&D: Research and Development

LNS: Loans

PRG: Program Activities

FI: Financial Incentives

PRC: Procurement Programs

DEM: Demonstration Programs

INF: Information and Education Programs

STD: Standards and Guidelines

## 8 Policies in Place in Norway

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**Name of initiative:** Investment Tax Exemption

**Type of initiative:** Financial incentive

**Objective:** To establish markets for new technologies for energy generation from renewable energy sources.

**Relevant government department:** Ministry of Finance

**Description:** Investments in renewable energy (including biomass and solar energy), heat pumps, district heating, natural gas grids, and small-scale hydro (less than 1,000 kW) and refurbishing of all hydro plants are exempt from the 7% investment tax.

**Year of implementation:** 1999

**Sub-sector targeted:** Biomass market development

**Name of initiative:** Research Council of Norway's Efficient, Renewable Energy Technologies Program

**Type of initiative:** Research and development

**Objective:** To develop products and processes for efficient energy technologies and new renewable energy sources in Norwegian enterprises.

**Relevant government department:** Ministry of Petroleum and Energy

**Description:** The objective of this program is to develop products and processes for efficient technologies and new renewable energy sources in Norwegian enterprises. One component of this is bioenergy (others include wind, photovoltaics, solar, wave, heat pumps, energy efficient technologies and hydrogen). Within bioenergy, research focuses on small combustion systems with low emissions, electricity and heat production from biomass, biofuels for engines and biomass-fired systems for medium to large buildings.

**Year of implementation:** 1995

**Sub-sector targeted:** Biomass conversion

**Name of initiative:** Exemption from Excise Taxes

**Objective:** To establish markets for new technologies and for energy generated from new renewable sources.

**Type of initiative:** Financial incentive

**Relevant government department:** Ministry of Finance

**Description:** Fossil fuels in Norway are subject to a CO<sub>2</sub> tax, a sulphur tax and an energy tax. Exemptions from all of these taxes are available for biofuels.

**Year of implementation:** The CO<sub>2</sub> tax was introduced in 1991

**Sub-sector targeted:** Bioenergy market development

**Name of initiative:** Reduced Tax on Waste

**Type of initiative:** Financial incentive

**Objective:** To put a price on the emissions resulting from final treatment of waste and provide incentive for waste reduction and recycling.

**Relevant government department:** Ministry of Finance

**Description:** A tax on waste disposal has been in place in Norway for a number of years. The tax applies to waste delivered to landfills and incineration plants. The tax on waste disposal is reduced when waste is used as a source of energy. Beginning July 2003, the tax on incineration plants was changed to an emissions tax and a subsidy provided per kWh of energy produced.

**Year of implementation:** 1999

**Sub-sector targeted:** Bioenergy market development

**Name of initiative:** Consumption Targets

**Type of initiative:** Standards and guidelines

**Objective:** To produce 4 TWh per year by 2010 for district heating systems based on new renewable energy sources (including biomass).

**Relevant government department:** Ministry of Energy and Petroleum

**Description:** This goal was formulated in the government's White Paper on energy policies in 1999, and has been adopted by the Norwegian parliament. This objective was underlined by the White Paper defining the Norwegian climate policy, approved by Parliament in 2002.

**Year of implementation:** 2002

**Sub-sector targeted:** Bioenergy market development

**Name of initiative:** Enova (Norwegian Government Environment Fund)

**Type of initiative:** Loans

**Objective:** To contribute to environmentally sound and rational use and production of energy, relying on financial instruments and incentives to stimulate market actors and mechanisms to achieve national energy policy goals.

**Relevant government department:** Ministry of Petroleum and Energy

**Description:** The Norwegian Parliament set up an Energy Fund to provide grants of up to NOK 5 billion (CAN\$9.7 million) over a ten-year period. The funding will come from a levy on the electricity distribution tariffs and from ordinary grants in the national budget. Enova grants loans for projects that reduce emissions of greenhouse gases and other environmentally harmful gases and for energy efficiency investments. One of the program areas of Enova aims to improve deployment of renewable energy, including bioenergy.

**Year of implementation:** 2002

**Sub-sector targeted:** Bioenergy market development

Table 12 summarizes the policies in place in Norway related to bioenergy.

**Table 13. Summary of Policies Related to Bioenergy in Norway**

Name of Initiative	Type of Initiative	Sub-Sector Targeted
Investment Tax Exemption	Financial incentive	Biomass market development
Research Council of Norway's Efficient, Renewable Energy Technologies Program	Research and development	Biomass conversion
Exemption from Excise Taxes	Financial incentive	Bioenergy market development
Reduced Tax on Waste	Financial incentive	Bioenergy market development
Consumption Targets	Standards and guidelines	Bioenergy market development
Enova (Norwegian Government Environment Fund)	Loans	Bioenergy market development

Table 13 tallies the policies presented above according to the sub-sector targeted and the type of policy employed. Here too, the government has largely pursued financial incentives related to bioenergy market developments to facilitate and promote bioenergy production and consumption.

**Table 14. Norway Policy Trend Identification Matrix**

Target	R&D	LNS	PRG	FI	PRC	DEM	INF	STD
Availability								
Harvesting and Supply Systems								
Conversion	✓							
Market development		✓		✓ ✓ ✓			✓	✓

R&D: Research and Development

LNS: Loans

PRG: Program Activities

FI: Financial Incentives

PRC: Procurement Programs

DEM: Demonstration Programs

INF: Information and Education Programs

STD: Standards and Guidelines



## 9 Policies in Place in Brazil<sup>12</sup>

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**Name of Initiative:** PRIONFRA

**Type of Initiative:** Procurement

**Objective:** To increase the availability of electrical energy produced by enterprises that are Independent Autonomous Producers, working collectively in wind energy, small central hydroelectric and biomass in the National Interconnected System (SIN).

**Relevant government department:** Ministry of Mines and Energy (National Agency of Electric Energy)

**Description:** On April 26, 2002, the Brazilian Government announced PRIONFRA, an alternative energy sources incentive program. This program aims to increase the participation of electric energy produced by independent producers from wind, small scale-hydro and biomass. Power plants that come online before December 30, 2006 receive a 15-year power purchase agreement in which the purchase of produced energy is guaranteed over that period of time. This agreement also guarantees a price for the electricity from renewable sources. The program is the first step to the implementation of a more diversified energy mix and to reorganize the generation, transmission and distribution of energy in the country to avoid energy rations in the future.

**Year of implementation:** 2002

**Sub-sector targeted:** Bioenergy market development

**Name of Initiative:** National Fuel Alcohol Program (PROALCOOL)

**Type of Initiative:** Procurement, financial incentives, loans, standards and regulations

**Objective:** To increase the portion of the country's fuel requirements derived from domestic sources, with ethanol as the main focus.

**Relevant government department:** Ministry of Mines and Energy

**Description:** This program significantly contributed to the market development for ethanol that took place in Brazil, especially in the 1980s. There were several components to this policy:

- Guaranteed purchase of all of the fuel ethanol that was produced by the state-owned oil company Petrobras.
- A fixed producer price for ethanol.
- Low interest rate loans for agro-industrial enterprises willing to produce ethanol.
- Minimum ethanol content in gasoline of 22% anhydrous ethanol in gasoline.
- The pricing of hydrous ethanol to make it attractive to consumers. The price of hydrous ethanol fuel at the pump head was set at only 59% of the price of gasoline.<sup>13</sup>
- Reduced tax on ethanol.
- Tax incentives for consumers to purchase ethanol-only vehicles.

**Year of Implementation:** 1975

**Sub-sector targeted:** Bioenergy market development

Although Brazil has only implemented two key policies related to bioenergy, these policies combined are quite comprehensive. There is a focus both on biomass for electricity generation and ethanol for the transportation sector, and a range of policy types (from loans to procurement to financial incentives) has been implemented. Brazil is only lacking a focus on national research and development policies.

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<sup>12</sup> The Brazilian Government has not defined a comprehensive research and development program to support renewable energy.

<sup>13</sup> The Brazilian government managed the national fuel market by controlling the price of gasoline, which was approximately double the US price for gasoline at the time the National Fuel Alcohol Program was implemented.

## 10 Policies in Place in South Africa

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There is one major policy in place in South Africa related to bioenergy. The 2002 National Treasury budget included a 30% rebate from the general fuel levy for environmentally friendly alternative diesel fuels (biofuels). This rebate is administered by the South African Revenue Service.

Except for this policy, there are virtually no formal policies in place in South Africa specifically related to bioenergy. Agricultural production in South Africa is carefully guarded by the Department of Water Affairs and Forestry (the managing authority) and the possibility of transferring land from agriculture to biomass crop production currently seems unlikely.<sup>14</sup> Thus, there are no policies to facilitate conversion of land from conventional agricultural production to biomass crop production, and biomass inventories are lacking.

Indeed, biodiesel production in South Africa is currently limited to the following three manufacturers:<sup>15</sup>

- Mr. Johan Minnaar currently produces approximately 200,000 litres of biodiesel a year for use in his own farming enterprises.
- Biodiesel South Africa currently produces approximately 220,000 litres of biodiesel. The biodiesel is supplied to local industries for use in furnaces and boilers, but markets in the farming sector are also being considered. Biodiesel South Africa has entered into agreements for seed-oil imports to facilitate further increases in production.
- Mr. Michael Lynott currently produces approximately 270,000 litres of biodiesel per year. He intends to increase his production for export purposes and is presently negotiating with Tanzania, Kenya, Mozambique, Botswana, Zambia, Zimbabwe and the Bahamas.

While the only formal policy in South Africa related to bioenergy is that of the tax rebate for biodiesel, current developments imply that over time a more comprehensive set of policies may be established. The Department of Minerals and Energy recently released the *White Paper on the Promotion of Renewable Energy and Clean Energy Development*.<sup>16</sup> Cabinet is currently set to approve the White Paper. With respect to bioenergy, the White Paper states that biofuels and bioenergy will “be supported.” The paper does not, however, state what the nature of support will be and in what timeframe it will be established. Thus, while the Renewable Energy White Paper may provide a basis for developing a coordinated bioenergy strategy for South Africa in the future, it currently does not contain specific policies or programs to manage or promote bioenergy.

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<sup>14</sup> Tony Golding, personal communication, January 14, 2003

<sup>15</sup> Obermyer, E. 2001. *An Overview of International Biodiesel Experience*. South Africa: National Treasury Republic of South Africa.

<sup>16</sup> Department of Minerals and Energy. 2002. *White Paper on the Promotion of Renewable Energy and Clean Energy Development*. South Africa: Government of South Africa.

## 11 International Summary

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Table 14 summarizes the types of policies in place in the regions included in this study. For the purpose of this table, the check marks previously presented have been replaced by the name of the country. This allows for comparison between countries as well as the identification of trends across all countries.

The table demonstrates the range of policies currently in place in the countries under consideration and the main policies used to overcome each of the barriers identified in this analysis. For example, key policies related to availability are research and development and financial incentives. Research and development, program activities and financial incentives are used to overcome barriers related to biomass harvesting and supply systems. Research and development is the main policy tool for addressing limitations related to biomass conversion. While market development is dominated by the use of financial incentives, all types of policies are targeted at this sub-sector.

Overall, the dominant policy tool related to biomass and bioenergy is that of financial incentives. Such policies have been implemented by all of the countries included in this analysis and are targeted at every sub-sector. The vast majority of financial incentives, however, are targeted at bioenergy market development. There are also a significant number of financial incentives targeted at biomass availability. Such policies are in place in Sweden, the United States and the United Kingdom.

Research and development policies are also very common. Such policies have been targeted at all sub-sectors, although they are largely focused on biomass conversion and biomass availability. Sweden and the United States currently dominate research and development policies.

Only the United States has implemented key policies targeted at every sub-sector. As well, the United States has implemented the broadest range of types of policies. European countries have concentrated much more on a few kinds of policies, mainly financial incentives but also research and development.

**Table 15. Summary of International Policies Related to Bioenergy**

Target	R&D	LNS	PRG	FI	PRC	DEM	INF	STD
<b>Availability</b>	Sweden, United States		United Kingdom	Sweden, United States, Finland, United Kingdom				
<b>Harvesting and Supply Systems</b>	Finland, United States		Finland, United Kingdom	Finland, United Kingdom				
<b>Conversion</b>	Sweden, Finland, United States, Germany, Norway	Germany	United States, United Kingdom	United States		Sweden, United States		
<b>Market Development</b>	United States	United States, Norway, Brazil	United Kingdom	Sweden, Finland, United States, United Kingdom, Germany, Norway, Brazil, South Africa	Sweden, United States, Brazil	United States	United States, Norway	Sweden, United States, Finland, United Kingdom, Germany, Norway, Brazil

R&amp;D: Research and Development

LNS: Loans

PRG: Program Activities

FI: Financial Incentives

PRC: Procurement Programs

DEM: Demonstration Programs

INF: Information and Education Programs

STD: Standards and Guidelines

In describing the range of policies implemented in European countries such as those included above, it is important to note the influence of the EU on such policies. Policies implemented at the EU level often determine the type and extent of policies that member countries are able to implement. For example, the EU has established a directive that sets the target of doubling the share of renewables in global energy consumption from 6% in 1997 to 12% in 2010. Given this target, member states are required to adopt national targets that are aligned with the EU directive. In addition, as part of the EU target of doubling the share of renewable energy sources by 2010, the Commission has set a target of 7% of total energy consumption from bioenergy by 2010.<sup>17</sup> Member countries must similarly adopt appropriate policies at the national level. The EU has also established set-aside regulations that drive national policies in member countries. The EU set-aside regulations are meant to reduce agricultural overproduction. Under these regulations, farmers who set aside a portion of their land for non-food uses, including biomass, are eligible for a subsidy.

<sup>17</sup> European Commission. 2001. *Green Paper: Towards a European Strategy for the Security of Energy Supply*. Italy: European Commission. See [http://europa.eu.int/comm/energy\\_transport/doc-principal/pubfinal\\_en.pdf](http://europa.eu.int/comm/energy_transport/doc-principal/pubfinal_en.pdf)

## 12 Policies in Place in Canada

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**Name of initiative:** Future Fuels Initiative

**Type of initiative:** Loans

**Objective:** To accomplish a four-fold increase in Canada's annual ethanol production and use, reaching approximately one billion litres per year in 2010 with up to one-quarter of this coming from cellulosic feedstocks.

**Relevant government department:** Transport Canada

**Description:** The Future Fuels Initiative is part of the Government of Canada's Action Plan 2000 on Climate Change. The major component of the initiative is the renewal of the National Biomass Ethanol Program (NBEP), which provides contingent loan guarantees to encourage financing of new ethanol plants in Canada. It provides for \$140 million in contingent loan guarantees to encourage financing for three to six new ethanol plants. This new program builds on the success of the NBEP, which was launched in the mid-1990s to help overcome lender resistance to investing in large ethanol plants because of uncertainty about excise tax policy. The contingent loans are repayable at commercial rates of interest. In addition to the loan guarantees, the Future Fuels Program adds \$3 million over five years for a public outreach component to provide essential market information to retail consumers. The initiative also provides for such activities as public education on fuel ethanol, analysis of fuel ethanol markets and producer economics, research on a possible renewable fuel standard, and liaison with provinces and industries interested in ethanol plant expansion.

**Year of implementation:** 2001

**Sub-sector targeted:** Bioenergy market development

**Name of initiative:** Tax Exemptions for Ethanol Fuel and Biodiesel

**Type of initiative:** Financial incentive

**Objective:** To increase the supply and use of ethanol blended fuels in Canada.

**Relevant government department:** Ministry of Finance

**Description:** The federal government excludes ethanol used as a transportation fuel from the excise tax. This represents a \$0.10/litre exemption for the ethanol portion used in gasoline. Biodiesel is also eligible for a federal excise tax exemption. Numerous provincial governments also exempt ethanol from fuel taxes. For example, Ontario has a \$0.147/litre exemption, Manitoba has a \$0.25/litre exemption, Alberta has a \$0.09/litre exemption, and Saskatchewan has a \$0.15/litre exemption.

**Year of implementation:** Various

**Sub-sector targeted:** Bioenergy market development

**Name of initiative:** Refuelling Stations

**Type of initiative:** Procurement and demonstration

**Objective:** To reduce greenhouse gas emissions, demonstrate an alternative fuel technology, and support manufacturers that produce alternative fuel vehicles and fuel suppliers that offer alternative fuels.

**Relevant government department:** Natural Resources Canada

**Description:** The government of Canada owns 7 E85 refuelling stations.

**Year of implementation:** 2000

**Sub-sector targeted:** Bioenergy market development

**Name of initiative:** Bioenergy Development Program

**Type of initiative:** Research and development

**Objective:** To support the development of bioenergy as part of a strong commitment to sustainable development.

**Relevant government department:** Natural Resources Canada

**Description:** Natural Resource Canada's Bioenergy Development Program provides research and development support in the areas of biomass handling, combustion, biochemical conversion and thermochemical conversion. Currently, the focus of the program is on forestry wastes such as wood chips and sawdust, and agricultural wastes such as straw and chaff; work is also being done on the conversion of municipal wastes.

**Year of implementation:** 1981

**Sub-sector targeted:** Biomass harvesting and supply systems and biomass conversion

**Name of initiative:** Renewable Energy Deployment Initiative (REDI)

**Type of initiative:** Financial incentive

**Objective:** To stimulate the market demand for commercially reliable, cost-effective renewable energy systems for space and water heating and cooling.

**Relevant government department:** Natural Resources Canada

**Description:** REDI is a six-year, \$24 million program designed to stimulate the demand for renewable energy systems for space and water heating and cooling including highly efficient and low-emitting biomass combustion systems. The REDI offers businesses and institutions a financial incentive of 25% of the purchase and installation costs of a qualified system, to a maximum of \$80,000. In remote communities, businesses, organizations and other institutions may be eligible for a refund of 40% of purchase and installation of a qualified system, up to a maximum refund of \$80,000.

**Year of implementation:** Announced in 1997 and came into effect in 1998

**Sub-sector targeted:** Bioenergy market development

**Name of initiative:** Accelerated Capital Cost Allowance for Class 43.1

**Type of initiative:** Financial incentive

**Objective:** To encourage business and industry to reduce energy waste and to use renewable energy sources for energy production equipment.

**Relevant government department:** Ministry of Finance

**Description:** The Accelerated Capital Cost Allowance for Class 43.1 provides an accelerated capital cost allowance at a rate of 30%. Eligible investments include co-generation and specified waste-fuelled electrical generation systems, active solar systems, small-scale hydroelectric installations, heat recovery systems, wind energy conversion systems, photovoltaic electrical generation systems, geothermal electrical generation systems and specified waste-fuelled heat production equipment.

**Year of implementation:** 1998

**Sub-sector targeted:** Bioenergy market development

**Name of initiative:** Market Incentive Program

**Type of initiative:** Financial incentive

**Objective:** To raise public awareness of green power choices and increase the market share of green power, supporting promising renewable energy technologies and achieving greenhouse gas and other air pollutant emission reductions.

**Relevant government department:** Natural Resources Canada and Environment Canada

**Description:** This program provides financial support to electricity distributors interested in developing market-based programs that will increase sales of green power in the residential and small business markets. Natural Resources Canada and Environment Canada will provide a short-term financial incentive up to 40% of the eligible costs of an approved project. The total budget for this measure is \$25 million ending March 31, 2006.

**Year of implementation:** 2000

**Sub-sector targeted:** Bioenergy market development

**Name of initiative:** Green Power Procurement Program

**Type of initiative:** Procurement

**Objective:** To help interested utilities gain experience with different electricity products; achieve emission reductions in federal operations; and leverage first purchases to create viable green power markets.

**Relevant government department:** Public Works and Government Services Canada, Environment Canada and Natural Resources Canada

**Description:** The Government of Canada Action Plan 2000 on Climate Change announced a commitment to purchase 20% of federal electricity requirements from emerging renewable energy sources (ERES). The government aims to displace most federal purchases of high-carbon electricity with electricity from ERES. The budget for this Action Plan 2000 initiative is \$40 million over five years ending March 31, 2006.

**Year of implementation:** 2000

**Sub-sector targeted:** Bioenergy market development

**Name of initiative:** Canadian Forest Service Biomass for Energy Program

**Type of initiative:** Research and development

**Objective:** To identify sources of increased biomass supply, for both existing and new biomass; develop efficient methods of growing, harvesting, collecting and transporting biomass; and demonstrate the sustainability of increased biomass supply.

**Relevant government department:** Natural Resources Canada

**Description:** The program consists of assessing biomass resources in the fields of forestry and agriculture and developing methods to grow fibre for the production of bioenergy. This includes harvesting technologies, transport system efficiencies, and storage systems as well as designing scenarios to improve supply.

**Year of implementation:** 2000

**Sub-sector targeted:** Biomass harvesting and supply systems

**Name of initiative:** Advanced Combustion Technologies

**Type of initiative:** Research and development

**Objective:** To reduce emissions of acid rain precursors, greenhouse gases, particulates, and identified priority substances, trace elements and organic compounds.

**Relevant government department:** Natural Resources Canada

**Description:** This program assists industry in developing cleaner and more energy-efficient combustion processes. Research on combustion processes focuses on optimizing the performance of stationary equipment and evaluating and developing new products, fuels and retrofit technologies. Processes under study use conventional fuels (oil, coal and natural gas) as well as biomass and specialty fuels.

**Year of implementation:** 1993

**Sub-sector targeted:** Biomass conversion

**Name of initiative:** Renewable Energy Technology Program

**Type of initiative:** Research and development

**Objective:** To support Canadian industry's efforts to develop renewable energy technologies, including bioenergy (combustion, biochemical conversion of biomass to ethanol, thermochemical conversion of biomass to bio-oil and biogas), active solar and wind energy.

**Relevant government department:** Natural Resources Canada

**Description:** The program provides cost-sharing and technical assistance in support of technology development and field trials. Two strategic approaches have been adopted: accelerated penetration of renewable energy technologies into Canadian markets, and the exploitation of international opportunities.

**Year of implementation:** 1989

**Sub-sector targeted:** Biomass conversion

**Name of initiative:** Consumption Target

**Type of initiative:** Standards and guidelines

**Objective:** To guide future developments of bioenergy in Canada.

**Relevant government department:** Natural Resources Canada

**Description:** This initiative aims to increase ethanol production to support the introduction of ethanol blending in 25% of the gasoline supply. A proposed next step is to increase the target for ethanol blending to 35% of the gasoline supply, and to set a target of 500 million litres of biodiesel in use by 2010. Note that these are targets only and there is currently no formal plan for achieving them.

**Year of implementation:** 2000

**Sub-sector targeted:** Bioenergy market development

Table 15 summarizes the policies in place in Canada related to bioenergy.

**Table 16. Summary of Policies Related to Bioenergy in Canada**

<b>Name of Initiative</b>	<b>Type of Initiative</b>	<b>Sub-Sector Targeted</b>
Future Fuels Initiative	Loans	Bioenergy market development
Tax Exemptions for Ethanol Fuel and Biodiesel	Financial incentive	Bioenergy market development
Refuelling Stations	Procurement and demonstration	Bioenergy market development
Bioenergy Development Program	Research and development	Biomass harvesting and supply systems and biomass conversion
Renewable Energy Deployment Initiative	Financial incentive	Bioenergy market development
Accelerated Capital Cost Allowance for Class 43.1	Financial incentive	Bioenergy market development
Market Incentive Program	Financial incentive	Bioenergy market development
Green Power Procurement Program	Procurement	Bioenergy market development
Canadian Forest Service Biomass for Energy Program	Research and development	Biomass harvesting and supply systems
Advanced Combustion Technologies	Research and development	Biomass conversion
Renewable Energy Technology Program	Research and development	Biomass conversion
Consumption Target	Standards and guidelines	Bioenergy market development

Table 16 tallies the policies presented above according to the sub-sector targeted and the type of policy employed. As was the case with other regions, Canada has mainly focused on the use of financial incentives related to bioenergy market development. Research and development programs have focused on biomass harvesting and supply systems and biomass conversion.



**Table 17. Canada Policy Trend Identification Matrix**

Target	R&D	LNS	PRG	FI	PRC	DEM	INF	STD
Availability								
Harvesting and Supply Systems	✓ ✓							
Conversion	✓ ✓ ✓							
Market development		✓		✓ ✓ ✓ ✓	✓ ✓	✓		✓

R&D: Research and Development

LNS: Loans

PRG: Program Activities

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PRC: Procurement Programs

DEM: Demonstration Programs

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STD: Standards and Guidelines

## 13 International Comparison with Canadian Initiatives

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Table 17 compares the policies in place in Canada with those implemented in other regions. This table does not describe the number or magnitude of the policies pursued by other countries. Rather, it indicates those countries that have implemented various types of policies and the bioenergy sector to which they are targeted. To a certain extent, the initiatives implemented in Canada have been consistent with those in other regions. As is the case internationally, research and development programs in Canada have focused on overcoming barriers associated with harvesting and supply systems and conversion. Similarly, in Canada, as in other regions, we see a focus on the use of financial incentives to stimulate market development.

The table below reveals that financial incentives are the dominant policy type. Further evaluation of the use of financial incentives may therefore be warranted. Initial consideration of the use of financial incentives in the various countries studied reveals several trends. First, virtually all of the countries included in this analysis provide tax exemptions for bioenergy. This includes CO<sub>2</sub> tax, energy tax, fuel tax, investment tax, excise tax, and climate change levy exemptions. Second, many regions have implemented investment grants to support the purchase, implementation or use of bioenergy technologies. Third, policies that provide direct support for bioenergy production (in the form of \$/kWh) are established in several countries including Sweden, the United States, Finland and Germany.

The main divergences in policy approaches between Canada and other regions seem to be, in Canada, the lack of policies targeted specifically at biomass availability, financial incentives for more than just market development, and financial incentives in the form of direct support for production of bioenergy (\$/kWh).

Sweden, the United States, Finland and Germany all have financial incentive policies specifically targeted at biomass availability. These incentives (in the form of \$/ha of land) provide a direct and on-going incentive to landowners to establish and harvest energy crops.

In addition, countries such as Sweden, the United States, the United Kingdom, Finland and Germany have implemented financial incentives, not only for the purpose of market development, but also to increase biomass availability, harvesting and supply systems and conversion. Similar policies appear to be lacking in Canada.

Finally, several countries considered in this analysis provide direct support for bioenergy production. Sweden, the United States, Finland and Germany all provide support (in the form of \$/kWh) for bioenergy production. No such policy exists in Canada. Indeed, financial incentives in Canada are dominated by the use of tax exemptions and investment grants.

**Table 18. Policies Related to Bioenergy in Canada and Other Countries**

<b>Target</b>	<b>R&amp;D</b>	<b>LNS</b>	<b>PRG</b>	<b>FI</b>	<b>PRC</b>	<b>DEM</b>	<b>INF</b>	<b>STD</b>
<b>Availability</b>	Sweden, United States		United Kingdom	Sweden, United States, Finland, United Kingdom				
<b>Harvesting and Supply Systems</b>	Finland, United States, Canada		Finland, United Kingdom	Finland, United Kingdom				
<b>Conversion</b>	Sweden, Finland, United States, Germany, Norway, Canada	Germany	United States, United Kingdom	United States		Sweden, United States		
<b>Market Development</b>	United States	United States, Norway, Brazil, Canada	United Kingdom	Sweden, Finland, United States, United Kingdom, Germany, Norway, Brazil, South Africa, Canada	Sweden, United States, Brazil, Canada	United States, Canada	United States Norway	Sweden, United States, Finland, United Kingdom, Germany, Norway, Brazil, Canada

R&amp;D: Research and Development

LNS: Loans

PRG: Program Activities

FI: Financial Incentives

PRC: Procurement Programs

DEM: Demonstration Programs

INF: Information and Education Programs

STD: Standards and Guideline

## 14 Final Summary, Conclusions and Next Steps

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The purpose of this report is to identify and describe international policies related to bioenergy and to compare such policies with those in place in Canada. To that end, the report presents information on bioenergy-related policies in Sweden, the United States, the United Kingdom, Germany, Finland, Brazil and South Africa. For each initiative are described the kind of policy implemented and the sub-sector to which it is targeted. The same is done for policies implemented in Canada. This comparison is useful for benchmarking the type and range of policies that have been implemented internationally related to bioenergy production and consumption. The analysis revealed the following country trends:

- In Sweden, there is a heavy focus on the use of research and development and financial incentives. Research and development programs focus on biomass availability and conversion while financial incentives are concentrated on facilitating market development.
- The United States places a heavy focus on research and development and financial incentives. Within research and development, programs are mainly targeted at biomass availability and conversion. Financial incentives are mainly geared towards market development. The United States also has a number of information and education programs in place.
- Finland places a strong focus on financial incentives. Such policies are targeted at all biomass sub-sectors and especially market development.
- Policies and programs in the United Kingdom focus on the use of financial incentives, which have especially been geared towards biomass availability and bioenergy market development.
- In Germany, there is a strong reliance on financial incentives, especially related to market development.
- The government in Norway has also largely pursued financial incentives related to bioenergy market development.
- South Africa recently implemented a financial incentive for the market development of biofuels.
- In Canada, there is a focus on financial incentives for bioenergy market development. Research and development programs in Canada are mainly targeted at biomass harvesting and supply systems and conversion.

In conclusion, the following comments are warranted:

- All countries place a heavy focus on the use of financial incentives.
- Financial incentives are mainly focused on bioenergy market development, although such policies are also targeted at biomass availability, harvesting and supply systems and conversion.
- Research and development policies are primarily targeted at biomass conversion.
- The United States has the widest range of policies both in terms of the types of policies employed and the sub-sectors to which they are targeted.
- Unlike other countries, Canada has not implemented financial incentives towards biomass availability, harvesting and supply systems and conversion.
- Several countries have implemented direct production support (\$/kWh) for bioenergy. Canada has not implemented such a policy.

Further analysis should be aimed at evaluating in detail financial incentives related to bioenergy production and consumption. This would include, for example

- an evaluation of the political, market and legal drivers behind bioenergy financial incentives.
- an evaluation of policies both at the state/provincial and European Union levels.
- an evaluation of the relative scale of support provided through financial incentives in the various regions.
- a correlation of the level of support with bioenergy production and consumption.

- a correlation of the level of support with biomass resource availability.
- an evaluation of policy design differences across regions.