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A BIOMASS BLUEPRINT TO MEET 15% OF OECD ELECTRICITY DEMAND BY 2020

THE THREAT OF CLIMATE CHANGE

CLIMATE CHANGE IS EMERGING AS ONE OF THE BIGGEST THREATS TO NATURE AND NATIONAL ECONOMIES WORLDWIDE. ITS EFFECTS ARE INCREASINGLY APPARENT. MELTING ICE, DAMAGING FOREST FIRES, CHANGING DISTRIBUTION PATTERNS OF PLANTS AND ANIMALS, CORAL BLEACHING, DESERTIFICATION, AND EXTREME AND DESTRUCTIVE WEATHER EVENTS ARE JUST SOME OF THE TELLTALE SIGNS.

A key climate threat is electricity generation. Every year, we burn fossil fuels – coal, oil, and gas – that have taken half a million years to form. While the full impacts of the resulting carbon dioxide (CO2) gas emissions will only become truly apparent in the decades to come, we are already feeling the 'heat'. If we really want to prevent catastrophic climate change, we will have to make radical alterations to the ways in which we generate energy. One major solution lies in the contemporary, cutting-edge use of the oldest fuel known to man – wood.

Woody biomass – also known as biomass from forestry and farming – has the potential to become a major source for future electricity generation. By utilizing modern and efficient technologies, biomass offers a source of clean energy that can gradually replace coal and other fossil fuels, bringing environmental benefits, supporting rural development and creating new employment opportunities.

If no action is taken, economic losses from extreme weather will be larger than GDP by 2065. But the future is not yet written.

Source: Chartered Insurance Institute, UK

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THE 15% BIOPOWERSWITCH! BLUEPRINT

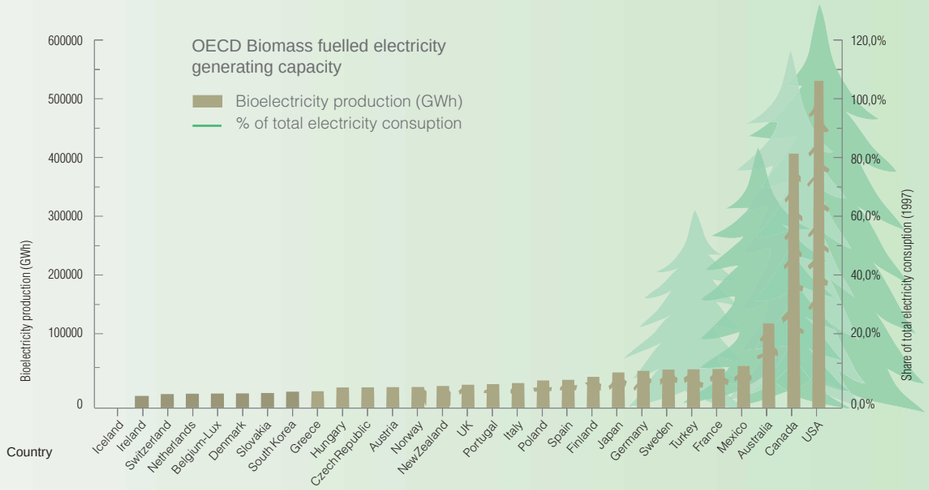
WWF AND THE EUROPEAN BIOMASS INDUSTRY (AEBIOM) HAVE DRAWN UP A BLUEPRINT FOR ACHIEVING 15% OF ELECTRICITY PRODUCTION FROM BIOMASS USE IN INDUSTRIALIZED COUNTRIES BY 2020 – COUNTRIES WHERE BIOELECTRICITY CURRENTLY REPRESENTS ON AVERAGE ABOUT 1% OF PRODUCTION CAPACITY.

Based on the conservative assumptions that power demand in industrialized countries (OECD) will double by 2020, the 15% target is feasible and realistic. It requires exploitation of a quarter of the potential collectable agricultural, forestry and livestock residues in countries and the dedication of 5% of their crop, forest and woodland area to the growing of woody biomass for energy. With stronger energy savings and efficiency policies, the power share of biomass could even reach 30%.

Industrialized countries between them have over 1,500 million hectares of crop, forest and woodland, of which some 460 million hectares are cropland. Achieving the 15% target could require an average of 1.25 million hectares of cropland per year to be converted to energy plantations. This represents just over 2% of the total land area in industrialized countries.

A 15% biomass target would result in a more than ten-fold increase in bioelectricity capacity by 2020 and over 200GW of new installed capacity.

Potential electricity production from biomass in industrialized countries in 2020



MAKING IT HAPPEN

WOODY BIOMASS HAS THE POTENTIAL TO BECOME A MAJOR SOURCE OF SUSTAINABLE AND SAFE POWER OVER THE NEXT TWO DECADES. THE MAIN CONSTRAINTS ARE COMMERCIAL AND POLICY BARRIERS, RATHER THAN TECHNICAL ONES.

Hence, strong and clear policy signals will be required to drive a modern bioelectricity industry along the pathway to a low-carbon energy future. To achieve this, governments must:

- Make renewable energy and energy efficiency the basis of greenhouse-gas mitigation strategies and swiftly implement the Kyoto Protocol under the UN Climate Change Convention.
- Take the lead in the development of bioelectricity by setting ambitious and specific targets for the post 2010 period.
- Redirect agricultural subsidies towards development of a stable biomass fuel supply by allowing perennial woody and grass energy crops to benefit from incentive schemes and at realistic scales.
- Stimulate biomass energy demand through preferential tariffs or quotas for biomass power, capital grants for project development, and public procurement for labelled green power.
- Establish energy strategies that include local and regional planning guidelines to stimulate the development of biomass generation. This should be based on the determination of raw material supplies at regional or landscape levels.
- Develop public task forces to stimulate biomass power, involving agriculture, forestry, environment, trade and industry, transport, and finance ministries.
- Promote site-specific best practice guidelines for biomass production, including ways of ensuring effective implementation and monitoring.

Full information on the Imperial College London report *BioPower Blueprint: Achieving 15% of Electricity from Biomass in OECD Countries by 2020* is available from www.panda.org/climate

AGRICULTURE POLICIES AND BIOMASS PRODUCTION

The recent reform of the EU Common Agriculture Policy introduced a new payment to promote energy crops. However, this area-based energy crop payment is insufficient to stimulate the development of a biopower industry since it is limited to 1.5 million hectares of land only, and is primarily supporting intensive arable crops, such as oilseed rape, for biofuel purposes. Instead, payments should be made available for more efficient and sustainable energy crops such as short-rotation forestry.

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THE BIOMASS RESOURCE

THE 15% BIOPOWER BLUEPRINT CLEARLY SHOWS THAT THERE NEEDS BE NO LAND-USE CONFLICT BETWEEN BIOMASS USE FOR ENERGY AND THE PRODUCTION OF CROPS FOR FOOD AND FIBRE IN INDUSTRIALIZED COUNTRIES.

The raw material for bioenergy comes from three main sources:

- Residues – from crops, animal husbandry, logging, and co-products from industrial wood processing such as sawmills
- Dedicated 'energy plantations' – from agricultural or forestry-based activities such as annual crops and short-rotation tree plantations
- Woody biomass – wood fuels from multi-purpose forests.

These resources are abundant and can realistically supply one to three quarters of world energy demand. Globally, about 50% of the potentially available residues are associated with forestry and wood-processing industries, about 40% are agricultural residues (mainly straw, rice husks, and sugarcane and cotton residues), and 10% animal manure.

Examples of biopower sources

Biomass resources	Examples
Dedicated plantations	• Short-rotation trees such as poplar and willow • Perennial crops such as Miscanthus (a tall woody grass).
Existing Forests	• Small dimension roundwood from thinnings and felling operations
Residues from agricultural production	• Straw from a variety of cereal crops • Other residues from food and industrial crops such as sugarcane, tea, coffee, rubber trees and oil andcoconut palms.
By-products and wood residues from a variety of processes	• Sawdust, bark chippings, wood shavings, black liqueur, plywood residues • Manure • Sewage sludge • Used vegetable cooking oil.

The potential global contribution of bioenergy in 2050 will be substantial with a input estimated at 50%.

Source: World Energy Assessment, 2000, UNDP, UN Department of Economic and Social Affairs, World Energy Council.

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TECHNOLOGY AND ECONOMICS

THE TECHNOLOGY FOR HARNESSING POWER AND HEAT FROM BIOMASS FUELS IS ALREADY AVAILABLE.

Electricity generation from biomass fuels currently uses the same basic technology used in power plants that burn solid fossil fuels. However, new technologies are being developed to improve power production efficiency from biomass. The potential also exists for local sources of electricity production from biomass by using small-scale gasification plants or systems involving fermentation of biomass.

By factoring in the pollution-related environmental and social costs generated by fossil and nuclear fuels, bioelectricity becomes a competitive energy source, as show in Box 1. The cost of biomass fuel supply depends on the cost of producing or recovering the 'feedstock' – raw materials – and those incurred during its transport and pre-processing prior to use in a power plant. Costs vary widely, from extremely cheap for existing residues that simply require disposal, to relatively expensive for production and use of dedicated energy plantations.

Ultimately, the cost of bioelectricity will depend on the economics of feedstock supply, power generation technology, the scale of operation, and the extent to which fossil fuel power plants can be adapted for biomass fuels.

Combined heat and power (CHP or cogeneration) results in a more efficient use of biomass and could contribute significantly to the economic viability of electricity from biomass.

Biomass can be burned in modern boilers to generate heat, electricity, or combined heat and power. High efficiencies of over 80% can be achieved with combined generation of heat and power.

External costs for electricity production in the EU for existing technologies

Country	Coal & lignite	Oil	Gas	Biomass
Germany	3 - 6	5 - 8	*1 - 2	3
U.K.	4 - 7	3 - 5	1 - 2	1
France	7-10	8 - 11	2 - 4	1

* Sub-total of quantifiable externalities (such as global warming, public health, occupational health, material damages.

Source EC (2003), External costs: Research Results on socio-environmental damages due to electricity and transports

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THE BENEFITS

CLIMATE PROTECTION: BIOMASS IS A CARBON-NEUTRAL POWER SOURCE IN THAT CO2 ABSORBED BY THE RAW MATERIAL WHILE GROWING OFFSETS THAT GENERATED DURING COMBUSTION.

Adopting the 15% Biopower Blueprint will deliver cuts in CO2 emissions of up to 1,800 million tonnes annually, equal to the combined emissions of Germany and the United States. At present CO2 emissions in industrialized countries totals some 12,000 million tonnes – a figure projected to rise to more than 14,000 million tonnes by 2020.

Carbon dioxide emissions per kilowatthour of electricity produced (CO2 in g/kWh):

- Coal: best practice – 955
- Oil: best practice – 818
- Gas: combined cycle turbine – 446
- Energy crops: current practice – 17-27
- Energy crops: future practice – 15-18

EMPLOYMENT CREATION: UNLOCKING THE POTENTIAL OF THE 15% BIOPOWER BLUEPRINT IS EXPECTED TO CREATE UP TO 400,000 JOBS IN INDUSTRIALIZED COUNTRIES BY 2020.

This estimate is based on research that has shown that two direct and indirect jobs are created for every megawatt of bioenergy installed (source: EC [2000] 'Biocosts' study). Another advantage is that employment could be generated where there is often the greatest need – in rural areas. Here, the production of biomass fuels offers a new income stream for cash-strapped farmers. In countries with economies in transition, where agriculture already employs a significant percentage of the national workforce, biomass production can strengthen job security.

Carbon recycled as biomass accumulates in energy crops and forests and is consumed in a power station – resulting in no net carbon dioxide emissions from burning the biomass.
A: *Carbon dioxide (CO2) is captured by the growing crops and forests;*
B: *Oxygen (O2) is released and carbon is stored in the biomass of the plants;*
C: *Carbon in harvested biomass is transported to the power station;*
D: *The power station burns the biomass, releasing the CO2 captured by the plants back to the atmosphere.*

Based on life cycle emissions from conventional electricity generation in the UK.
Source: Benign Energy: The Environmental Implications of Renewables, 1998, IEA (1998).

THE ENVIRONMENT

THE DEVELOPMENT OF BIOMASS RESOURCES AND THE CONSERVATION OF BIODIVERSITY AND LOCAL ENVIRONMENTS CAN GO HAND IN HAND.

The environmental advantages of biomass production include:

- Substituting fossil fuel use with a CO2-neutral alternative
- Reducing emissions of other atmospheric pollutants, such as sulphur
- Protecting soil and watersheds
- Increasing or maintaining biodiversity
- Reducing fire risk in forestry

These benefits provide a powerful argument for accelerating the introduction of biomass energy in virtually all industrialized countries. However, because the production of biomass feedstocks differs between growing sites, the development of 'one size fits all' policies should be avoided.

To maximize likely benefits and minimize potential impacts, the following guidelines should be followed:

- Biopower schemes need to be subject to rigorous and transparent environmental impact assessments.
- Good agricultural and forestry practices must be adopted, suitable for local conditions.
- There should be no conversion of natural forests or High Conservation Value habitats involved in raw material production or supply.
- Biomass growing practices must protect and enhance soil fertility.
- Water use should be assessed throughout the production and conversion chain, with particular emphasis on avoiding damage to watersheds.
- On the production side, best available conversion technologies should be used to minimize emissions.
- Ash quality from conversion processes should be monitored and where possible nutrient-rich ash should be recycled back to the land.

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