



EREC

Eritrean Renewable Energy Council



RENEWABLE ENERGY

The solution to climate change



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A key solution to climate change

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RENEWABLE ENERGY - THE SOLUTION TO CLIMATE CHANGE

Renewable energy - A key solution to climate change



Original photograph taken in 1928 of the Upsala Glacier, Patagonia, Argentina



Climate Impact Documentation Patagonia (Chile : 2004). Composite image of Upsala Glacier, Patagonia, Argentina.

"As a climate scientist who has worked on this issue for several decades, first as head of the Met Office, and then as co-chair of scientific assessment for the UN Intergovernmental Panel on Climate Change (IPCC), the impacts of global warming are such that I have no hesitation in describing it as a "weapon of mass destruction".

Sir John Houghton

Climate change is arguably one of the greatest environmental threats the world is facing. The impacts of disruptive change leading to catastrophic events such as storms, droughts, sea level rise and floods are already being felt across the world.

While the Kyoto Protocol, which aims to reduce greenhouse gas emissions is slowly impacting on energy markets, scientists are increasingly advising policymakers that carbon emission reductions of beyond 60% are needed over the next 40-50 years. How will we achieve such a dramatic reduction in carbon emissions?

At the heart of the issue is an energy system based on fossil fuels, that is mainly responsible for greenhouse gas emissions.

On the contrary, renewable energy provides one of the leading solutions to the climate change issue. By providing 'carbon-neutral' sources of power, heat, cooling and transport fuels, renewable energy options such as wind, solar, biomass, hydro, wave and tidal offer a safe transition to a low carbon economy.

The concept of a transition to a carbon-free economy has become broadly understood and been outlined by many actors from G8¹, the United Nations, the International Energy Agency, Governments and industry alike. In the long run, renewables are the only energy source that provide a sustainable carbon neutral energy supply.

This briefing outlines the role that renewable energy can play in reducing greenhouse gas emissions such as carbon and methane. It highlights the success to date and the activity already happening across Europe and the rest of the world. It assesses its potential, and identifies how renewable energy is central to climate change policy and delivering large carbon dioxide reductions.

1. G8 - Group of Eight industrialized countries, G8 countries are Canada, France, Germany, Italy, Japan, Russia, the United Kingdom and the United States



Malawi Famine Documentation (Malawi : 2002) Farmers show their destroyed maize crop following drought throughout the Southern Cone of Africa in Nkana Khoti Village.

Climate Change - already happening

"Climate is an angry beast and we are poking at it with sticks"

Wallace Broecker, Ocean Circulation Researcher, New York's Lamont-Doherty Earth Observatory

According to the vast majority of climate scientists, climate change is already underway. The past decade has seen the warmest 6 years since records began. A third of global habitats are at risk, and extreme events such as floods, storms

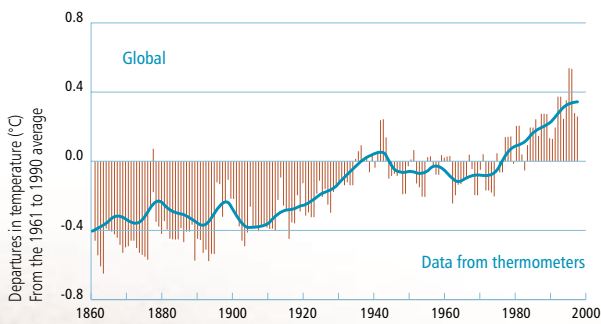
and drought are becoming more frequent. The financial consequences of climate change are also becoming apparent - with insurance claims due to weather-related damage increasing dramatically over the past few decades.

The Growth and Costs of major climate-related natural disasters

Decade	1950-1959	1960-1969	1970-1979	1980-1989	1990-1999
Number	20	27	47	63	89
Costs in Billion €	32,7	58,7	105,6	164	505,6

Source: Muenchner Rueck Versicherungsgruppe

Variations of the Earth's surface temperature for the past 140 years



Source : IPCC

The Inter-governmental Panel on Climate Change (IPCC)² stated in its Third Assessment Report in 2002 that: *"there is new and stronger evidence that most of the warming observed over the last 50 years is attributable to human activities."* It predicts that global average temperatures are likely to rise between 1.4 to 5.8 degrees Celsius over this century, depending on the amount of fossil fuels we burn and the sensitivity of the climate system.

2. The Intergovernmental Panel on Climate Change (IPCC) has been established by the WMO and the UNEP to assess scientific, technical and socio-economic information relevant for the understanding of climate change, its potential impacts and options for adaptation and mitigation. It is open to all Members of the UN and of the WMO.

"Climate is an angry beast and we are poking at it with sticks"

Australian Drought Background Documentation Barren landscape with thick fissures. Shot taken after a period of dryness that has caused extensive damage to cattle and prevented successful vegetation growth.

The IPCC identifies the following effects of an increase in global average temperature:

- ❑ Steady rise of the sea level
- ❑ Flooding of coastal areas
- ❑ Frequent extreme weather conditions
- ❑ Frequent poor harvest
- ❑ Water shortage
- ❑ Devastations
- ❑ Loss of biodiversity
- ❑ Increase of infections

A precautionary approach to this threat requires global temperature increase to be limited to less than 2 degrees Celsius above pre-industrial levels in order to prevent further damage. It is very likely that a more than one degree Celsius temperature increase in the climate system is already irreversible, so keeping to the 2 degrees limit will need urgent action over the next two decades. The rapid rise in the frequency and costs of natural disasters is beginning to make the costs of inaction transparent and many insurance companies are joining the call for reductions in fossil fuel use.

To achieve that will require keeping global CO₂ emission concentrations below 450 parts per million (ppm), a challenging task given that emissions are still increasing and that emission reductions in a number of industrialising countries are unlikely in the short term. That puts a major emphasis upon regions like the European Union to make deeper cuts in emissions.

Reducing Fossil Fuel Use is the Key Solution

The climate change problem is essentially a fossil fuel energy problem.

While agriculture, land-use changes, cement production and the use of chemicals all contribute to greenhouse gas emissions, more than 70% of the problem is due to the unsustainable use of fossil fuels. The climate change challenge means shifting away from fossil fuels in the home, industry, at work and the way we travel. Furthermore, global energy demand is predicted to rise as countries industrialise and population continues to grow.

City traffic jam in Rio de Janeiro. Queue of stationary cars and lorries nose to tail.

*Polar Bear,
Chukchi Sea,
near Russia.*



It can provide everything that fossil fuels currently offer in terms of energy services and by that dramatically reduce Climate Change Gas emissions:

- **Heating** - a range of renewable sources including solar water heating, passive solar heating in buildings, geothermal and the use of biomass such as forest residues and fast-growing energy crops
- **Cooling** - from biomass-powered systems or also solar cooling systems
- **Electricity** - from wind power, small-scale hydro, geothermal, biomass, PV cells, tidal and wave power
- **Transport fuels** - from liquid ethanol and biodiesel produced from plants,
- **Chemicals** - biofuels can provide a wide range of products currently based on oil and gas

Renewable Energy the Solution to Climate Change

"Climate change is a major challenge to sustainable development worldwide. This is increasingly recognised by forward looking political and business leaders. One of the key tasks we are facing is a profound transformation of our energy system over the next few decades, replacing fossil fuels with renewable energies and dramatically increasing energy efficiency"

Margot Wallström
Commissioner for the Environment,
May 2003 introduction
to Wind Force 12 (EWEA)

Renewable energy offers safe, reliable and increasingly cost-effective alternatives for all our energy needs - predominantly heating, cooling, electricity and motive power for transport.

Harnessing Renewable Energy in the Kyoto and UNFCCC Process

In the past decade, scientific concerns over climate change have fed through into international political action. More than 130 countries have signed the United Nations Framework Convention for Climate Change (UNFCCC). 119 countries have also signed up to the Kyoto Protocol, which sets out legally binding targets for a greenhouse gas reduction of 5.2% for industrialised countries. Many countries have already embarked upon national action plans to reduce greenhouse gas emissions. The European Union has a concerted climate change programme, including burden-sharing of emission reductions, renewable energy targets, and an Emissions Trading Directive due to start in 2005. Renewable energy features strongly within these national and regional initiatives.

"Climate change is a major challenge to sustainable development worldwide"

Renewable energy - Mainstream energy

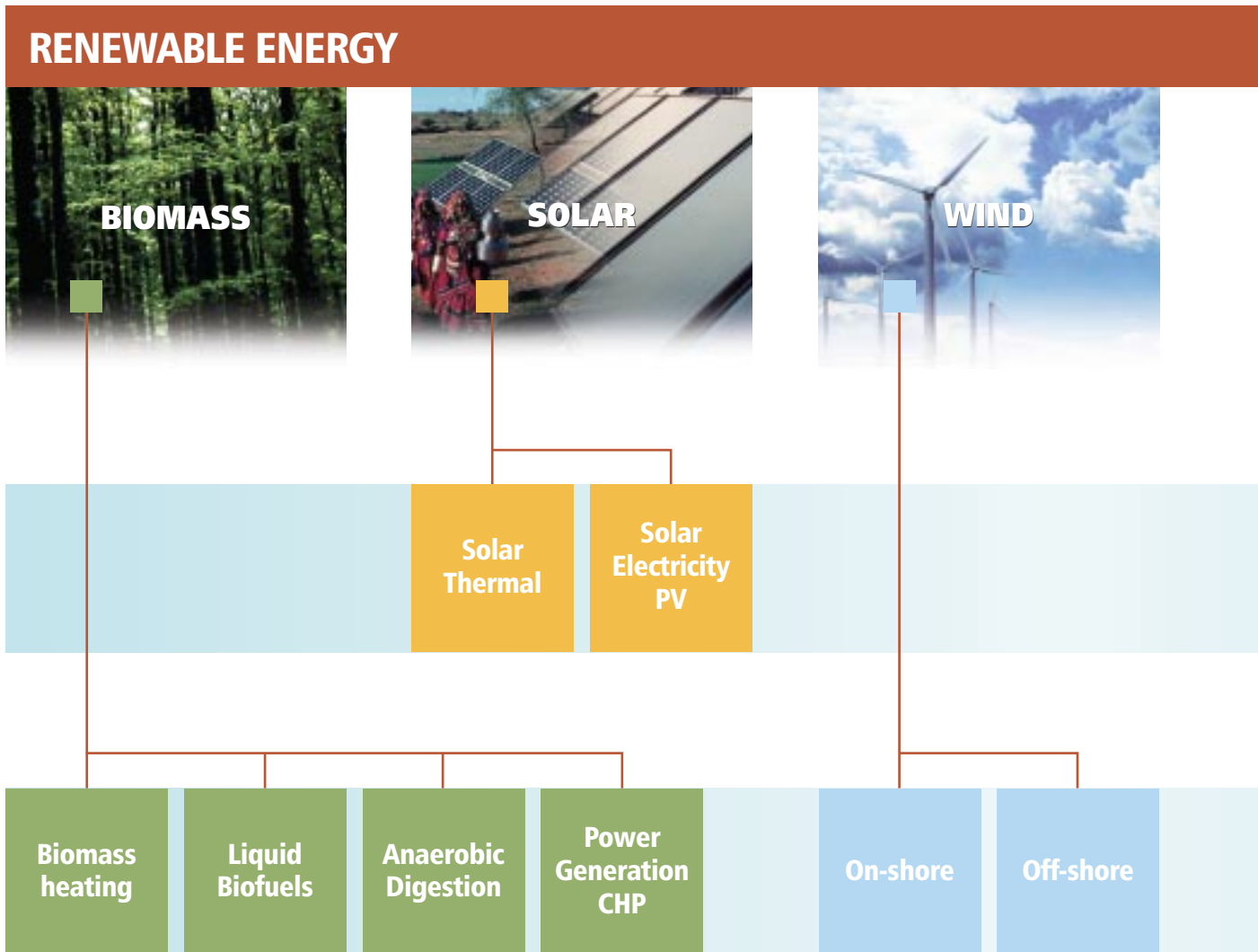
"It is the cost of setting up a policy structure that rewards the benefits of renewables: a level playing field. Though there will be a higher cost in the first decade... successfully promoting renewables over the period to 2030 will prove less expensive than taking a 'business as usual' approach."

Mark Moody-Stuart, Co-Chairman of the G8 Renewable Energy Task Force, 2001 and former Chairman of Shell International

The natural flows of energy on planet earth provide a huge potential for harnessing carbon-neutral energy for society. Powered by the sun, the flows of wind power, hydro power, biomass, wave, tidal and solar heat and power - which can be captured by modern

technology - are more than enough to provide for all our needs. The sun powers planet earth and allows us to survive. With smart technology it can also provide heat and electricity. It is also the driver for wind power. Wind in turn creates waves, a huge potential power

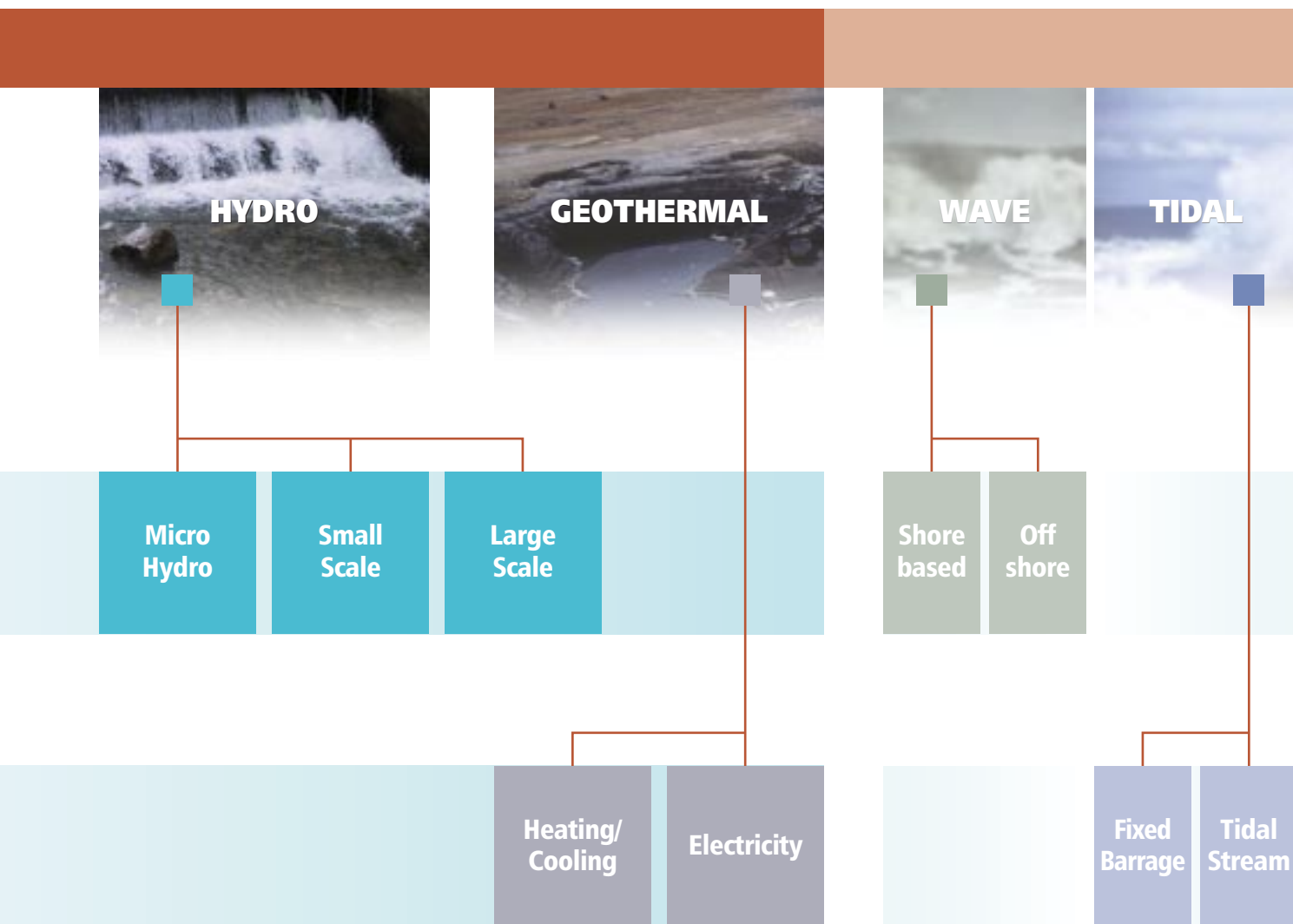
Renewable energy technologies



source being tested worldwide in prototype schemes. The sun also powers the evapo-transpiration cycle, which allows water to generate power in hydro schemes - currently the biggest source of renewable electricity in use today. Plants photosynthesise in sunlight and create a wide range of so-called biomass crops ranging from wood fuel to rapeseed, which can be used for heat, liquid fuels and electricity. Interactions with the moon produce tidal flows which can be intercepted and produce electricity. Though humans have been tapping into renewable energy such as wood, solar and

water power for thousands of years, so far we have managed to capture only a fraction of the technical and economic potential of renewables. The recent development of smarter and more efficient technology has been impressive. In the past 20 years these technologies have improved and costs have fallen dramatically. For solar photovoltaic (PV) cells, stimulated initially by the space programme, unit costs have fallen by a factor of 10 in the past 15 years. Onshore wind power at good sites can compete with traditional fuels, and modern biomass heating is invariably cheaper than oil heating.

“It is the cost of setting up a policy structure that rewards the benefits of renewables: a level playing field”





Photovoltaic roof and wind turbines in the Guerinda wind farms (Spain)

© Photos by courtesy of EHN

Why renewable energy?

With Political Commitment Renewables Can Deliver

While renewable energy technologies are often on a smaller scale than big fossil fuel and nuclear projects, they can be brought on-line quickly and with lower risks. The European Union has already set a target to reach a 12% share of renewables in total energy consumption by 2010. Renewables already have a significant share in many countries. Germany, for example, has doubled its renewable output in the past five years to 8% of total electricity, on the back of attractive feed-in tariffs for renewable electricity.

Denmark now gets 18 % of its electricity from wind power, and created an industry that has more jobs than the electricity sector itself.

Spain has leapt from virtually nothing to become the second biggest wind power country in Europe with over 6000 MW of capacity.

Countries such as Finland, Sweden and Austria have supported the development of very successful modern biomass power and heating industries through fiscal policies, sustained R&D



Pellets: Hand © ÖkoFen

support and synergistic forestry and industrial policies. As well as saving significant CO₂ emissions, equipment from all three countries is now exported worldwide.

Renewable energy technologies are already available, but not used enough. If all countries would focus on renewables in the same way as the most successful countries in terms of RES technologies growth rates, the results would be impressive.

Renewables provide greater security of energy supply

The European Commission's Green Paper on the Security of energy supply highlighted the importance of both renewable energy and energy efficiency in reducing dependence on imported oil and gas from areas that are mainly politically unstable. According to the Commission's Green Paper on Security of Energy Supply, in two decades Europe will be importing 70% of its energy (up from 50% today) unless we change direction.

"Renewable sources of energy have a considerable potential for increasing security of supply in Europe. Developing their use, however, will depend on extremely substantial political and economic efforts. (...) In the medium term, renewables are the only source of energy in which the European Union has a certain amount of room for manoeuvre aimed at increasing supply in the current circumstances. We can not afford to neglect this form of energy."

Source: Green paper on the security of energy supply, EC

Effectively, the only way of influencing European energy supply is to make serious efforts with renewable sources.

Renewables are Popular

The public continues to strongly support renewable energy, as proven by numerous opinion polls. A survey by the European Commission across the EU 15 countries in early 2003 showed that:

- 69% of the European Union (EU) citizens support more renewable energy-related research compared to 13% for gas, 10% for nuclear fission, 6% for oil and 5% for coal.
- 88% of EU citizens stated that global warming and climate change are serious issues which need immediate action.
- 75% of EU citizens answered that the use of fossil fuels (coal, oil, gas, etc.) contributes significantly to global warming and climate change.

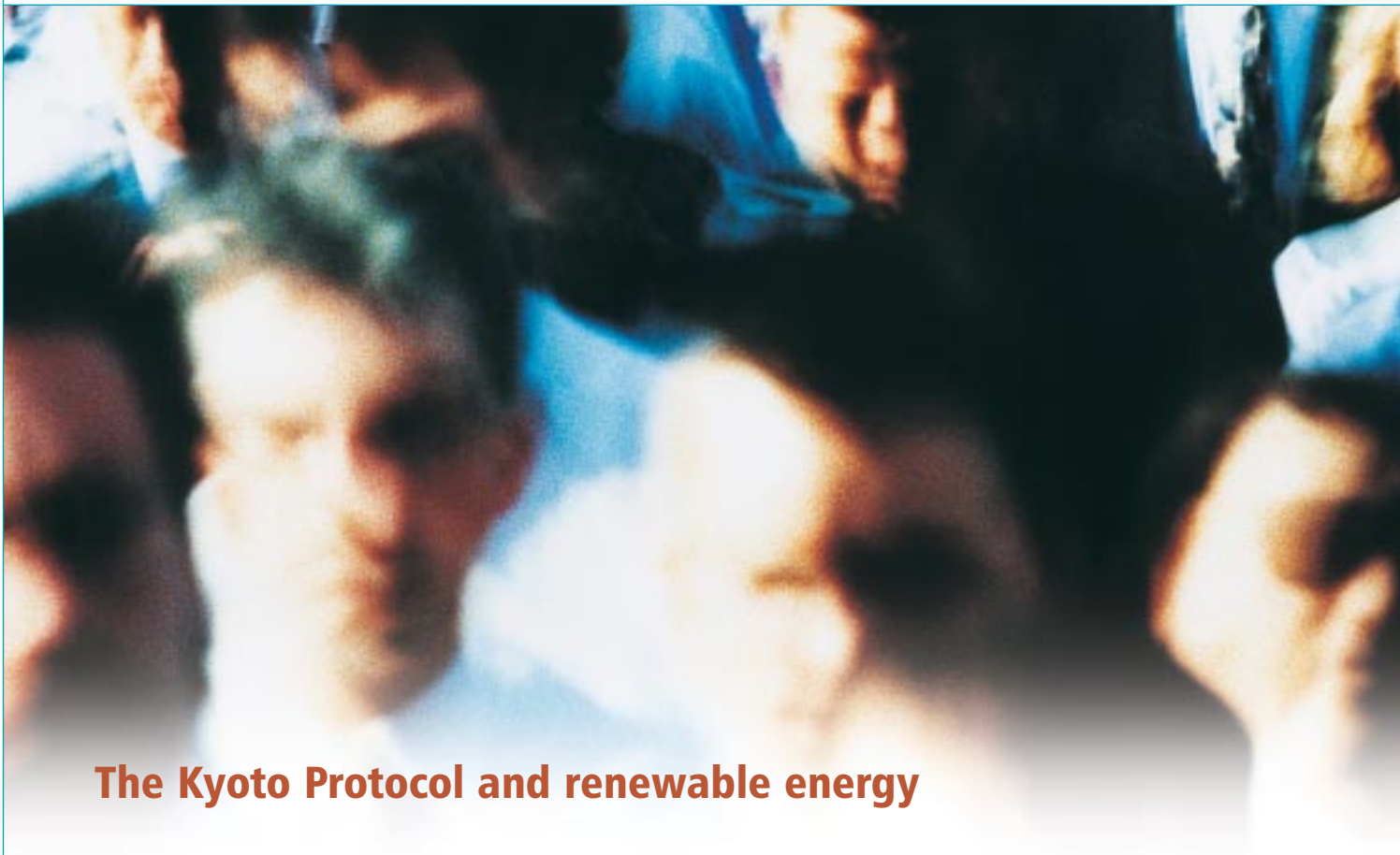
Renewables have the lowest environmental impact of all energy sources

Renewable energy technologies do have an impact on the environment, as do all energy technologies. However, the relative impacts of renewables are far less than those of fossil fuels and nuclear power. A major EU study (Extern-E) concluded that when climate change and the possible impact of catastrophic accidents of nuclear plants are taken account of, renewables have a significantly lower environmental impact.

Key Facts

- "Renewable energy technologies" utilise the natural flows in increasingly efficient and cost-effective ways.
- "Renewable energy technologies" can offer power, heating, cooling and transport fuels.
- "Renewable energy technologies" are extremely varied, allowing countries to maximise the local benefits depending on whether wind, solar, hydro or biomass energy is more accessible.
- "Renewable energy technologies" can deliver significant quantities of cost-effective energy and big carbon savings. With supportive policies, the role of renewables can grow very quickly as countries such as Germany, Denmark, Spain and Austria have already shown.

"Effectively, the only way of influencing European energy supply is to make serious efforts with renewable sources"



The Kyoto Protocol and renewable energy

"Energy is at the very core of the development agenda, but for development to be sustainable that energy needs to be clean. Increasing the use of clean renewable energy will have multiple benefits for rich and poor countries alike"

**Margot Wallström,
Commissioner for the Environment**

Under the Kyoto Protocol, legally binding greenhouse gas targets as well as ranges of flexible mechanisms were agreed. These so-called 'flexmex' instruments - Joint Implementation (JI), the Clean Development Mechanism (CDM) and Emissions Trading (ET) - allow countries and companies to buy and sell emissions with other countries who may either need to buy or have excess emissions to sell to others. A JI and CDM market has begun to develop, with various projects utilising renewable energy. However its potential as mechanism to promote renewables has barely begun and the benefits for renewables are not yet to be seen.

The three Kyoto mechanisms

The Kyoto Protocol comprises three flexible mechanisms that reduce GHG emissions:

Emissions Trading (ET)

This mechanism allows Annex I countries (e.g. between industrialised countries and countries that are undergoing the process of transition into a market economy) to buy and sell emission credits for the purpose of fulfilling their national emissions commitments. The Emissions trading must be supplemental to domestic actions and is based on governmental levels. This system will not start before 2008. However, independently from Kyoto, the European emissions trading system will start in 2005 and will already create mandatory emissions reduction across the European Union. However, the Emissions Trading scheme is a potentially effective and powerful tool to meet targets for reducing the emissions of greenhouse gases. But its limitations must be recognised. Emissions trading alone will not level the playing field between pollu-

Europe's role in the climate debate

The European Commission has taken several climate-related initiatives since 1991, when the first Community strategy to limit carbon dioxide was issued. The EU Council of Environment Ministers acknowledged the importance of taking further steps at Community level by asking the Commission to develop priority actions and policy measures.

European Climate Change Programme

The European Commission launched the European Climate Change Programme (ECCP) in June 2000 in order to identify elements for a

EU strategy to implement the Kyoto Protocol (e.g. proposal for an EU framework for emissions trading). During its second phase (2002-2003), several working groups investigated additional measures (e.g. to enhance Kyoto's Flexible Mechanism).

The ECCP is preparing an emissions trading scheme that will start to operate in 2005 in the European Union. In February 2003, the European Commission adopted a new Communication for a monitoring mechanism of GHG emissions, in order to comply with guidelines for the implementation of the Kyoto Protocol agreed at the Conference of the Parties 7 meeting in Marrakech in 2001. This Communication will help to achieve the target set on behalf of the European Community.

ting and clean technologies and it cannot substitute environmental CO₂ taxes or policies to promote renewables. Emissions trading is unlikely to benefit renewable energy sources in the short term. Trading emissions will not secure fully internalisation of external costs or contribute greatly to the polluter pays principle.

Joint Implementation (JI)

The second flexible mechanism "Joint Implementation" is a project-based mechanism. Industrialised countries and private companies based in these countries can invest in emission-saving projects in the territories of other Annex I parties when this is a cheaper option. Through such an investment in energy efficiency measures, renewable energy installations, or other projects that avoid or reduce greenhouse gas emissions, the investor acquires the right to the Emissions Reductions Units (ERUs) achieved by the project and can use those to meet its domestic emissions regulations. ERUs are allocated by the UNFCCC

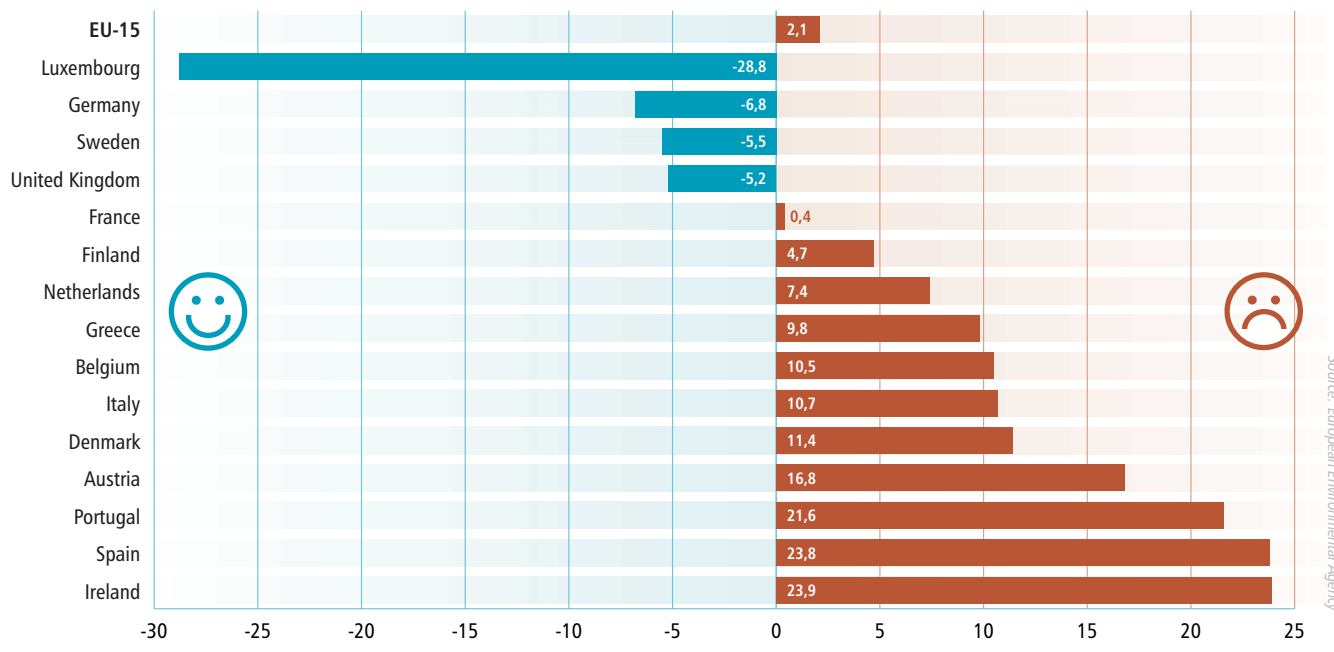
Secretariat. The host country must deduct the ERUs from its own assigned amount of emissions. JI must be supplemental to domestic actions. A Joint Implementation project might involve the use of RES, fuel switching for district heating, or reforestation. JI projects are likely to take place in Annex I Countries with economies in transition, with the aim to cut emissions at low costs. ERUs may only be issued from 2008.

Clean Development Mechanism (CDM)

CDM projects are aimed to promote sustainable development in developing countries, which are funded by industrialised countries (e.g. Member States of the European Union). These investments will generate Certified Emission Reductions (CERs). Small-scale projects will have a prior status under CDM - especially RES-projects below 15 MW. This mechanism has a project-based approach too. CDM started in 2000.

"Energy is at the very core of the development agenda, but for development to be sustainable that energy needs to be clean"

Deviation from linear Kyoto target path in 2001



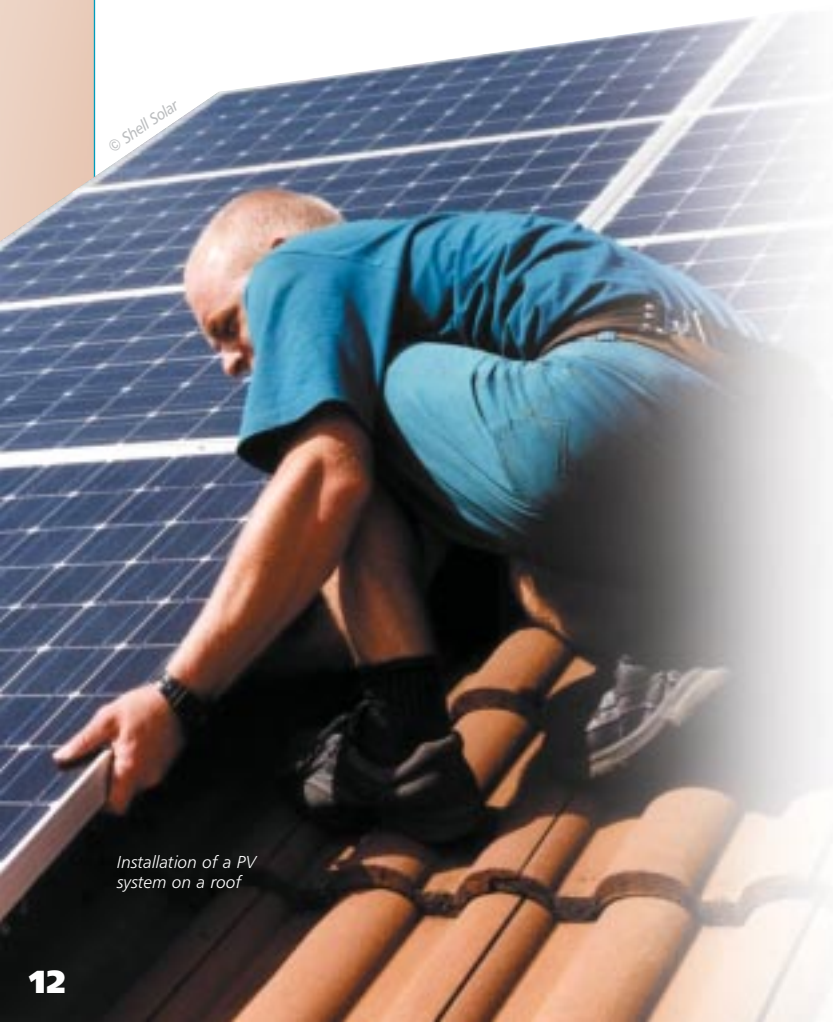
Source: European Environmental Agency

The EU's Emissions Trading Directive will come into force in 2005. It will allow emissions trading across the EU, covering many industrial sectors and the power sector.



Final installation of an offshore wind turbine

© Vestas



© Shell Solar

Installation of a PV system on a roof

Informal trading deals are already taking place, for example the UK already has a formal emissions trading market. While carbon prices in the past two years have generally been below €10/ton of carbon, this is providing a useful additional income to renewable and energy efficiency projects - however these mechanisms will not be a leading market driver for renewable technologies until prices changes and market imperfections for renewable technologies are addressed. Getting practical experience in renewable energy projects, market stimulation and development is important for their further development.

Europe is the frontrunner in renewable energy technologies. It created already more than 200,000 jobs in the EU with an annual turnover of more than 10 billion Euro.

Renewable energy - The solution to climate change

"We need to stop calling this alternative energy. It implies that it's just an alternative. But in fact it's an imperative. It's cleaner, it's better, it's smarter".

Sen. Hillary Rodham Clinton speaking at the Alternative Energy in New York Expo 2004, 2nd February 2004

Most of the key technologies are already working well in at least some parts of the EU.

- Wind, small-scale hydro and biomass heating are now widely accepted as viable and cost-effective options in a number of countries.
- Solar heating and electricity, and some types of biomass power are already cost-effective in niche markets and have good prospects of moving into all sectors as costs fall.
- Biofuels for transport will require better recognition of their low-carbon benefits through taxation policy.
- Tidal and wave power need further research and development before they can be commercialised.

Renewable energy should no longer have the alternative tag - it is a mainstream set of energy options able to provide cost-effective and reliable low-carbon energy. After extensive R&D and commercialisation over the past 20 years, wind power, biomass heating and power, solar heating and power and the other renewable energy options are important elements of the modern energy mix.

Renewable energy has some different characteristics to fossil fuels and nuclear power. Some of the technologies offer more intermittent power, and are less concentrated than oil or uranium. Taken as a group however, and utilising modern energy grids and networks, renewables can be integrated to provide predictable and reliable energy solutions.

CO₂ emissions savings through renewables

The benefits of renewable energy to greenhouse gas reduction are huge. The table shows that the CO₂ reduction due to the development of renewable energy sources during the period 2001-2010 will be 320 million tons per year in 2010, provided that the share of renewable energy sources in total consumption will have reached 12 % by that time. This amount rep-

CO₂ emissions reductions (Million tonnes)

	2010	2020
Wind	99	236
Photovoltaic	2.2	24
Biomass	176	326
Hydro	23	35
Geothermal	5.8	15
Solar Thermal	14	92
TOTAL RES	320	728
% of total EU 15 GHG (Greenhouse Gases) emissions in 1990	7.6 %	17.3 %

"We need to stop calling this alternative energy. It implies that it's just an alternative. But in fact it's an imperative"

resents 95 % of the EU Kyoto commitment of reducing green house gas emissions by 8% between 1990 and 2010. By 2020 the CO₂ reduction due to renewable energy sources could be 728 Mt/year, representing a

decrease of 17.3% of the total GHG emissions in the EU-15, provided that the share of renewables has reached 20% by that time, which is clearly feasible as several studies show.

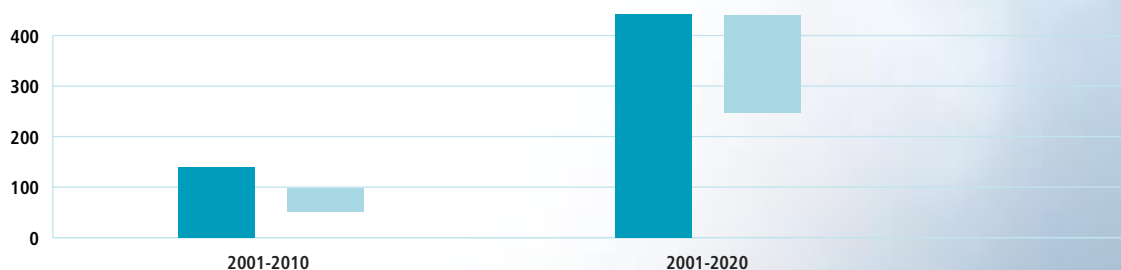
Avoided fuel costs and avoided external costs (in billion €)

	2001-2010		2001-2020	
	External	Fuel	External	Fuel
Wind	9,4 - 24	12,9	40,2 - 102,8	63
PV	0,2 - 0,5	0,2	2,7 - 6,8	4,3
Biomass	16,7 - 42,7		62,6 - 160,1	
Hydro	2,2 - 5,6	3,1	7,5 - 19,1	11,5
Geothermal	0,6 - 1,4	1,5	2,5 - 6,3	7,3
Solar Thermal	1,3 - 3,4	2,3	11,2 - 28,8	29,7
Total RES	30,4 - 77,6	20	126,7 - 323,9	115,8

Additional benefits, such as avoided fuel costs and avoided external costs of up to more than € 400 billion alone in the EU make renewables also to one of the

cheapest options in tackling climate change if compared to the investments needed.

Investments compared to avoided fuel costs and avoided external costs (in billion €)



Cumulative investment	140	443
Cumulative avoided costs (External+fuels)	50.4 - 97.6	242.5 - 439.7

Calculating with high external cost assumptions and average avoided fuel costs, the saved amount is nearly

as high as all the investments to be done in renewable energy deployment.

Future challenge

The national Governments and the European Union are challenged to create a future energy/environment

policy in order to react to the need of sustainable development and adequate economic growth. RES are an excellent step forward to meet the Kyoto targets and to combat climate change.

Which policy recommendations can be made?

Policy recommendations

Establishment of legally binding RES-targets

The current Member States and future Member States of the European Union, as well as other countries, should set up legally binding targets for renewable energy sources. The mandatory targets can also be complemented by financial incentives in the respective countries. This too, would be an effective climate policy.

Awareness of RES

Many decision-makers and politicians are not aware of the many results that can be derived by renewables. Therefore information campaigns are necessary as a tool to provide first-hand information and increase awareness towards the advantages of RES in the climate change debate.

Additionally, governments should be informed how RES projects can help them to reach their binding targets of CO₂ reductions under Kyoto.

More emphasis on RES-projects in development policy

In the current development policy, the developing countries' governments put little emphasis on RES. One of the main aims of Johannesburg is to create sustainable development in developing countries access to energy in order to fight against the vicious circle of poverty, which 2 billion people are still in at the moment, and to foster economic development without this putting pressure on the environmental equilibrium). The target can only be achieved with the use of renewable energy sources.

Support from International Financial Institutions

A special focus needs to be set on financial institutions. Financial resources should be mobilised to help developing countries to carry out their

obligations in the field of sustainable development. Funds (small- and medium-sized funds) should be provided for projects in the field of renewable energy sources. A significant part of financial institutions should go to the funding of RES projects for climate change purposes.

Change of subsidies-policy

The social and environmental costs of polluting energy are not internalised in current prices of conventional energy. A lot of countries worldwide pay (direct or indirect) subsidies to conventional energy. If this kind of policy is changed, renewable energy sources will be even more competitive.

None of these policy recommendations undermine its role as a viable and critical route to the low-carbon economy. All societies now have to

"Substantially increase the global share of renewable energy sources with the objective of increasing its contribution to total energy supply"

From Johannesburg 'World Summit on Sustainable Development' Plan of Implementation, 2002

"RES are an excellent step forward to meet the Kyoto targets and to combat climate change".



European Renewable Energy Council - EREC

EREC - the European Renewable Energy Council - is an umbrella organisation of the leading European renewable energy industry, trade and research associations active in the sectors of photovoltaic, wind, small hydropower, biomass and solar thermal:

- **EPIA** (European Photovoltaic Industry Association)
- **ESHA** (European Small Hydropower Association)
- **ESTIF** (European Solar Thermal Industry Federation)
- **EUBIA** (European Biomass Industry Association)
- **EUREC AGENCY** (European Association of Renewable Energy Research Centers)
- **EWEA** (European Wind Energy Association)

The Renewable Energy House

EREC shares its office with several of its member associations in the Renewable Energy House in Brussels, the central meeting point for renewable energy actors in the capital of Europe.

European Renewable Energy Council Renewable Energy House

26, rue du Trône - 1000 Brussels
T : +32 2 546 1933
F : +32 2 546 1934
E : erec@erec-renewables.org
I : www.erec-renewables.org

