



THE CLEAN ENERGY VOYAGE

Around the world in key destinations

UNITED NATIONS ENVIRONMENT PROGRAMME



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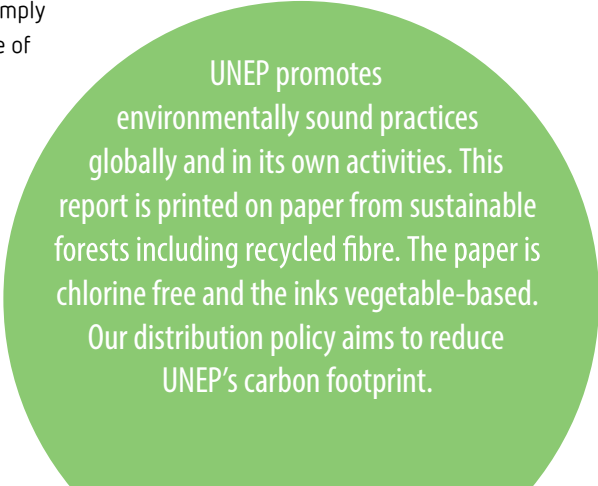
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AROUND THE WORLD



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FOREWORD

WHEN RENEWABLE ENERGY TECHNOLOGIES

emerged from the lab to the marketplace, the refrain by many was they would not work. When they did work, they were often dismissed as too expensive or unrealistic on a large scale.

Yet, since 2000 when UNEP published *Natural Selection: Evolving Choices for Renewable Energy Technology and Policy*, renewable energy use has grown dramatically, costs have tumbled and largescale projects are up and running with many more in the “pipeline”.

The latest assessment by the Frankfurt School of Finance and Management-UNEP Centre and Bloomberg New Energy Finance (BNEF) shows that since 2006, investments worth US\$1.3 trillion have been made in the renewable energy sector. In 2012, total renewable power capacity worldwide exceeded 1,470 gigawatts (GW), up by 8.5 per cent from 2011.¹

In just eight years since 2005, the number of countries with clean energy targets nearly tripled from 48 to 138, half of which are set by developing countries.²

Yet, myths and misunderstandings still abound. One of these asserts that renewable energy technologies are heavily subsidized. The truth, however, is quite different. Global data reveals that while clean energy received support totalling US\$88 billion in 2011, fossil fuels in both developed and developing countries attracted global subsidies of US\$523 billion in the same year.³

The fact is that renewable energy is no longer at the fringe, but rather plays a major role in powering the planet while generating decent jobs, combatting climate change, addressing poverty and assisting the transition to an inclusive green economy.

In this publication, UNEP would like to take the reader on a journey – a carbon emission-free virtual tour of some of the best illustrations of clean energy in all its forms, initiated by individuals and communities around the globe. Together, they are using their creativity, ingenuity, vision, as well as providing financial support, to provide clean energy in various forms. This exceptional tour is inherently limited, as positive developments continue to take place every day, which are beyond a single publication or snapshot in time.

The *Clean Energy Voyage* begins in the year 2000 and reaches its “destination” in 2030, the year chosen by the Secretary-General of the United Nations, Ban Ki-moon, to meet the objectives of the Sustainable Energy for All (SE4ALL) initiative.⁴

It always seems impossible until it's done.

Nelson Mandela

Together – from Kenya to the United States and Germany to the wind-swept plains of Mongolia and the rapidly emerging economy of China – these examples provide signposts for economies everywhere to imagine what is possible when they commit to a common goal.

Their experience demonstrates that our future and our energy system, in particular, is simply a matter of choice and policy shifts, rather than one of technological or financial constraints.

A global economy based increasingly on a shift to clean energy will require the combined dedication, skill and perseverance of individuals, communities and countries as a whole. It is happening, and now is the moment to accelerate and scale-up the extraordinary potential for a sustainable world that can support current and future generations.

UNEP is delighted to be a part of this clean energy story – not least because our new offices in Kenya generate electricity from a rooftop solar array and save enough energy from smart lighting systems and passive ventilation that we generate as much power as we consume.



Achim Steiner

UN Under-Secretary General and
Executive Director United Nations Environment Programme



YEAR 2000

Life can only be understood backwards, but it must be lived forward.

Soren Kierkegaard

As champagne corks popped to the flash of 10,000 lights around the Eiffel Tower at midnight, a new century took its first “breath”. At the same time, many IT managers were holding their collective breath. Even after spending billions in upgrades, many were predicting the infamous Y2K bug would create international chaos.

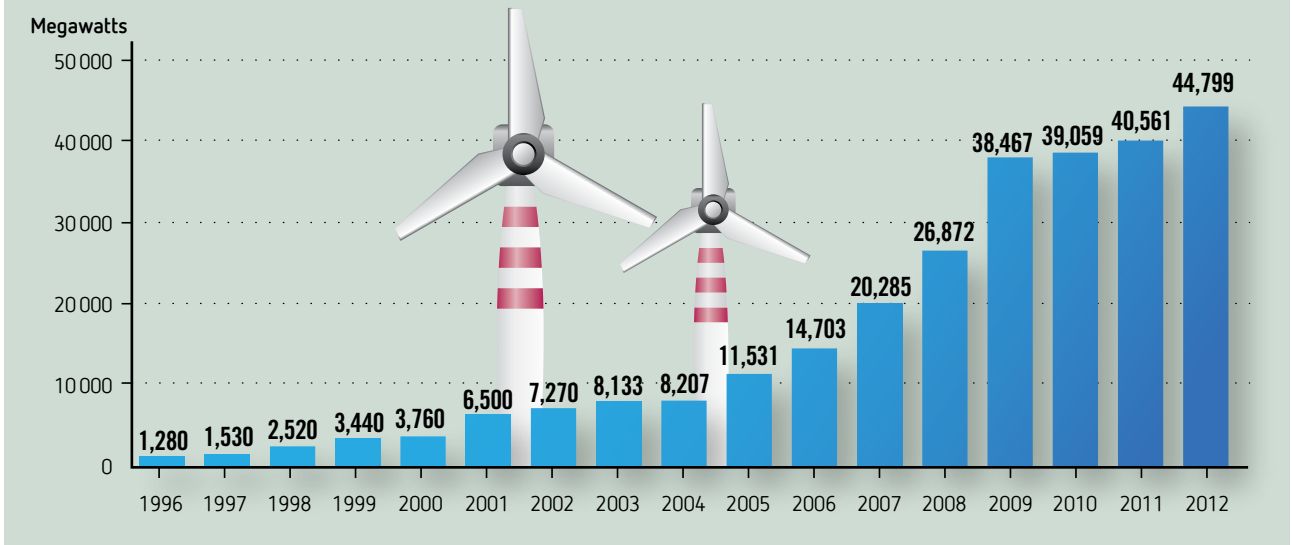
We were all wrong.

A few weeks later and less than a kilometre from the Eiffel Tower, officials at the International Energy Agency (IEA) were also making predictions about the clean energy industry. As with most of the conventional wisdom at the time, they said that by 2010, 34 GW of wind power would be installed across the globe. Across the Atlantic Ocean, the World Bank was predicting that China would have 9 GW of windpower installed by 2020 and only half a GW of solar PV.⁵ **We were all wrong again.**

The total capacity of windpower installed globally reached 200 GW in 2010. In China, in 2012, the installed windpower and solar PV capacity reached 75 GW and 7 GW, respectively.⁶

The predictions were not just wrong, they were off by a factor of 10, or achieved a decade earlier than expected. Such is the history of energy predictions – it is full of wildly missed projections, often made by highly experienced experts equipped with statistical data spawned by computers and other resources.

Figure 1. Global annual installed wind capacity 1996 – 2012



Source: GWEC, *Global Wind Energy Outlook*, 2012

This is not to single out individual predictions – everyone got it wrong, even those who were very optimistic. The European Photovoltaic Industry Association, for example, forecasted in 2000 that 2 GW of PV will be installed by 2010, instead 40 GW were installed.

There could be many reasons why it is difficult to assess scenarios when it comes to the issue of clean energy.

The answer has many facets, but one key factor is the idea that “trend is not destiny”. Assuming that the past will be the main driver for the future tends to confirm an existing bias and ignores a host of potential disruptive events that can dramatically change the course of a technology or policy.

Some countries without major fossil fuel resources, such as Denmark, Japan and Brazil, decided early on to encourage renewable energy and energy efficiency as a hedge against volatile energy prices and availability. In Denmark, for example, farmer cooperatives were allowed to develop local wind resources in early 1980s and connect their new wind generators to the Danish power grid.⁸

This was the first step that led to a multibillion-dollar Danish wind energy industry today with global exports, a situation that is similar to Japan’s solar PV industry. In the case of Brazil, the creation of its biofuel industry from sugar cane was born simply out of need. With limited funds to buy fossil fuels from other countries, Brazil concentrated on building what is now a



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