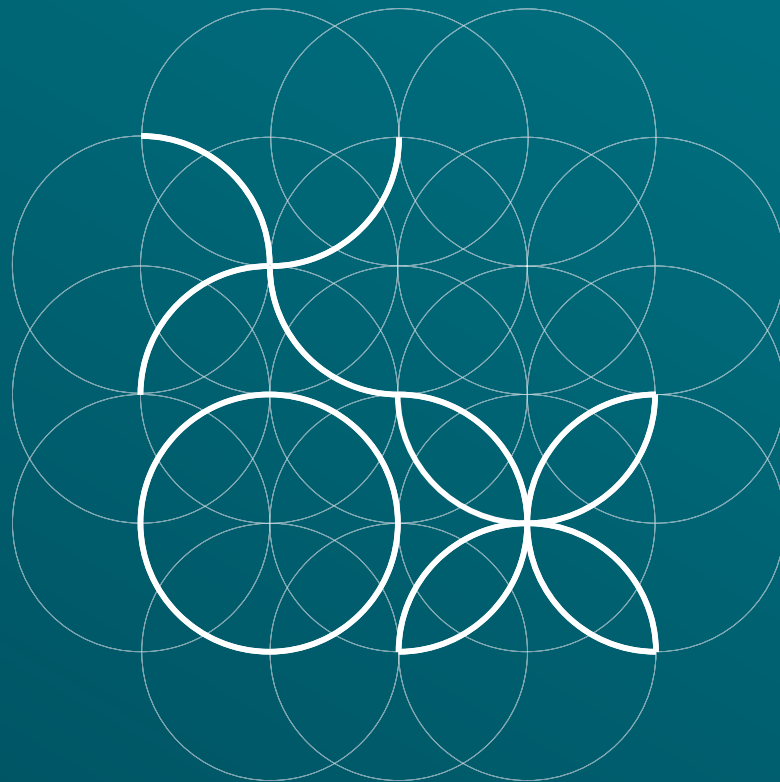


# RE-thinking 2050

A 100% Renewable  
Energy Vision for  
the European Union



EREC

EUROPEAN RENEWABLE ENERGY COUNCIL

Executive Summary

## Introduction

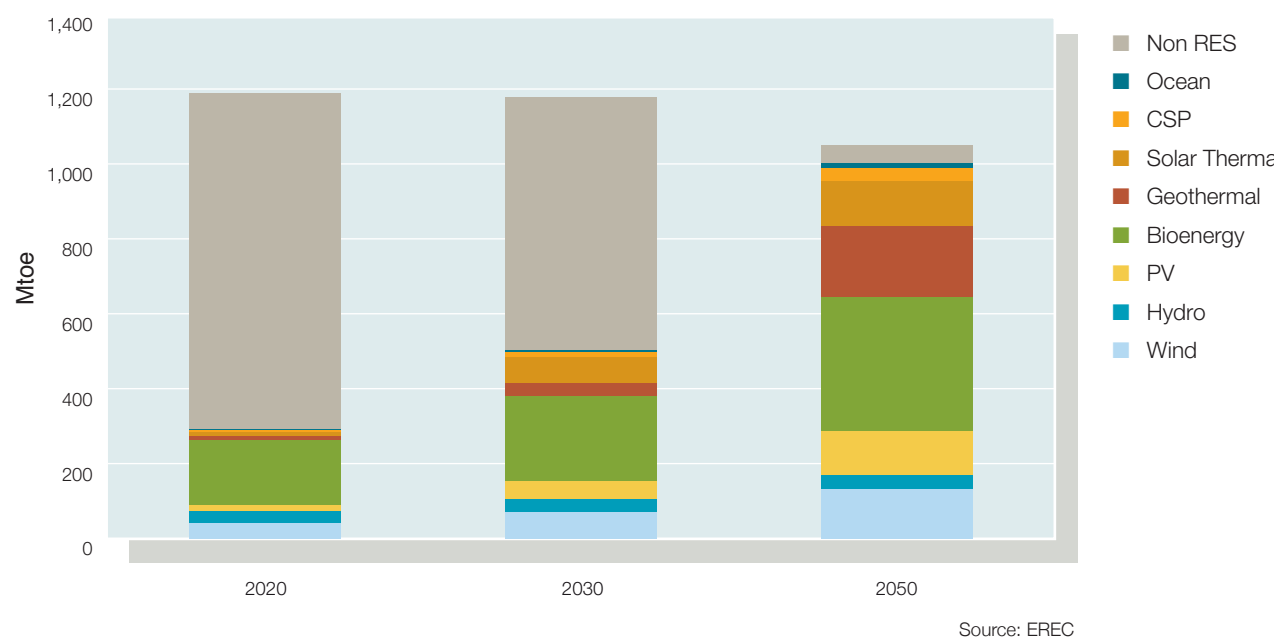
Europe's demand for energy is increasing in an environment of high and unstable energy prices. Greenhouse gas emissions are rising and the energy sector is one of the main emitters of greenhouse gases. Natural reserves of fossil fuels such as oil and gas are concentrated in just a few supplier countries around the world. Climate change along with an increasing dependency on energy imports are only a few of the risks the European economy is facing today. The EU now needs the courage to lead the way out of this climate and energy dilemma with a clear commitment to a 100% renewable energy future.

*RE-thinking 2050* presents a pathway towards a 100% renewable energy system for the EU in 2050, examining the effects on Europe's energy supply system and on CO<sub>2</sub> emissions, while at the same time portraying the economic, environmental and social benefits of such a system. Moreover, it provides policy recommendations for what is needed to fully exploit the EU's vast renewable energy potential.

## RE-thinking 2050: 100 % RES Contribution to Final Energy Consumption

*RE-thinking 2050* gives an outlook of the RES (renewable energy sources) industry, looking into how the different renewable energy technologies can contribute to a fully sustainable energy supply by 2050 provided there is strong political, public and economic support for all renewable energy technologies.

**Figure 1 Contribution of Renewable Energy Technologies to Final Energy Consumption**



The largest increase towards 2050 both in terms of energy output and contribution to final energy is projected for renewable electricity, in particular for pure power options such as wind and photovoltaics (PV). The share of renewable electricity in total final energy demand increases from 10% in 2020 to 18% in 2030 and finally to 41% by 2050.

As a sector, heating and cooling remains the largest contributor to final energy demand in 2050. The renewable heating and cooling market, comprising residential and industrial biomass as well as solar thermal and geothermal applications, is predicted to take off fast. Together, they hold a share of about 21% and 45% of total final energy consumption in 2030 and 2050 respectively.

In terms of growth rate, renewable energy in the transport sector can look forward to a significant increase, especially in the post-2020 years when advanced conversion technologies are ready to enter the market at a significant scale. The share of renewable transport fuels in overall final energy consumption increases from 3% in 2020 to 4% in 2030. In 2050 their share is likely to account for 10%.

Overall, *RE-thinking 2050* shows that even without an aggressive energy efficiency policy, the EU's could achieve an effective share of 96% renewable energy in final energy consumption by 2050. Uncertainties remain, however, regarding aviation and inland navigation. In the report it is assumed that those transport modes might still use fossil fuel in 2050. No assumptions are hence made on the use of biofuels in shipping or aircrafts, although they are already contributing at a pilot stage today.

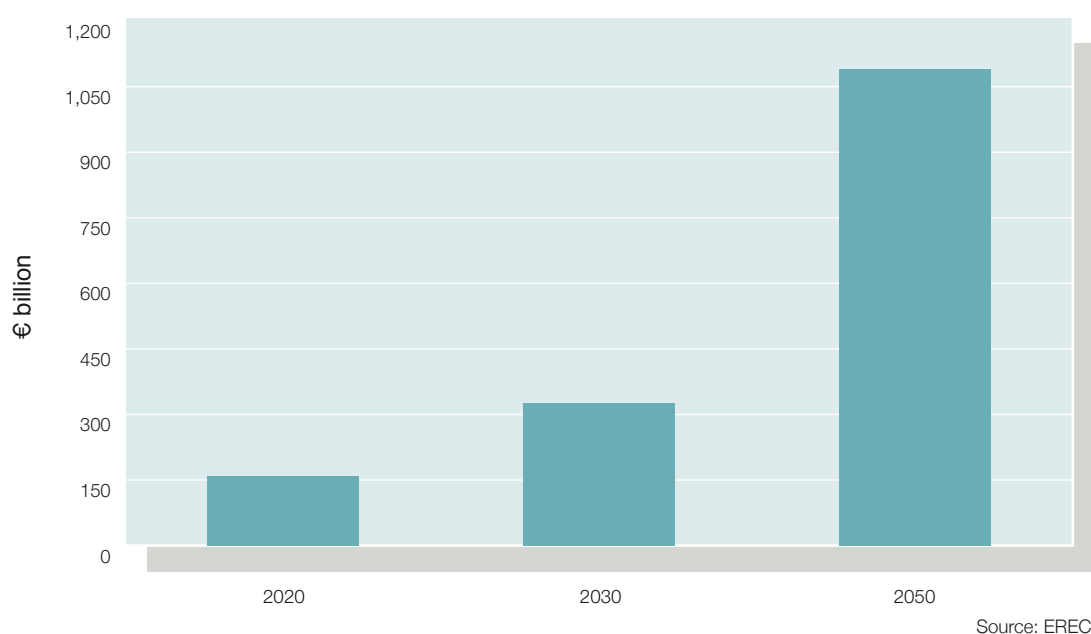
## Economic, Environmental and Social Benefits of a 100 % RES Supply

### Economic Benefits

#### Security of Energy Supply and Avoided Fuel Costs

By 2020, the EU can reduce its annual fossil fuel demand by over 290 Mtoe, reaching almost 500 Mtoe by 2030 and more than 1,000 Mtoe by 2050. Hence, renewable energy will avoid fossil fuel costs of about €158 billion in 2020, €325 billion in 2030 and about €1,090 billion (or more than €1 trillion) in 2050 (Figure 2).<sup>1</sup> The calculation is based on an exchange rate of \$1.35/€.

**Figure 2 Avoided Fuel Costs from RES Deployment (2020-2030-2050)**



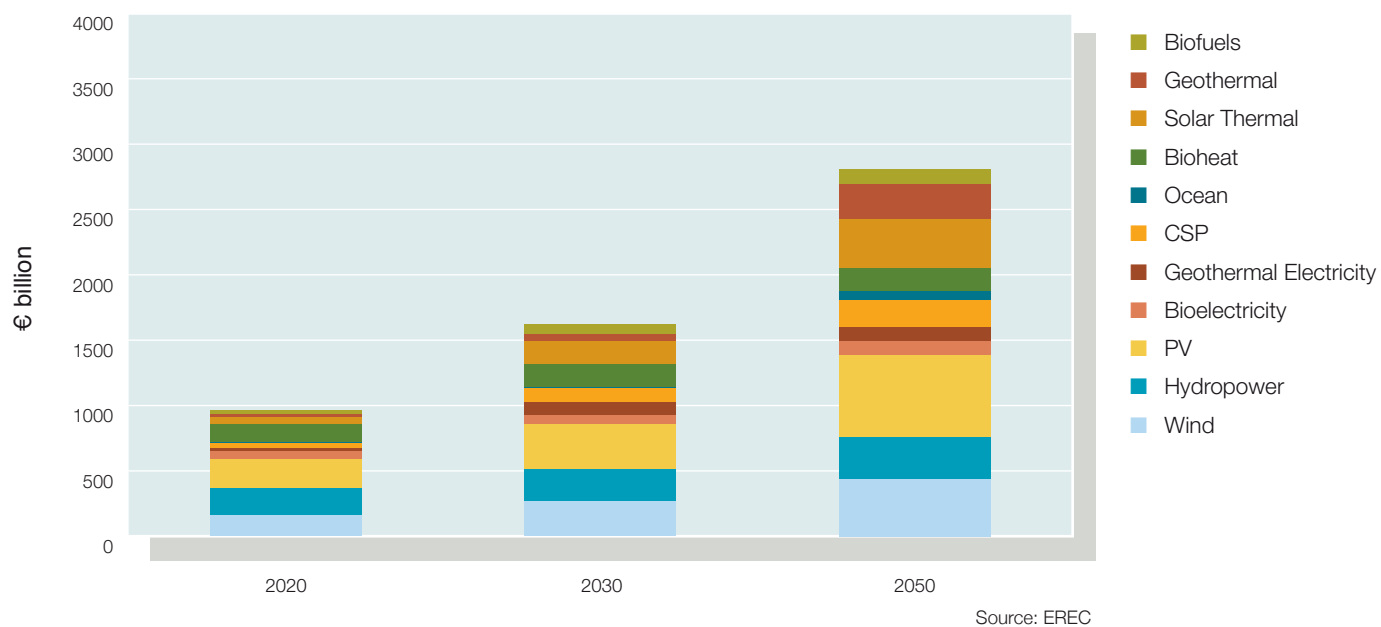
<sup>1</sup> Using a conversion factor of 1 tonne of oil equivalent (toe) = 7.33 barrels. Hence, with an oil price of \$100, for instance, one toe costs \$733. The underlying oil price assumption is for 2020 \$100/barrel, for 2030 \$120 and for 2050 \$200/barrel.

## Capital Investments

Reaching a share of 100% renewable energy in the EU by 2050 will certainly require additional investments. The size of such investments will depend on the implementation of energy saving and energy efficiency measures, the technology choices, decommissioning rates and the degree of competition in the energy sector as such.

When developing long-term scenarios spanning periods of several decades, the dynamic trend of cost developments over time plays a crucial role in identifying strategies. To analyse the long-term capital investment needs up to 2050, learning rates for each technology have been applied which reflect the correlation between cumulative production volumes of a certain technology and a reduction in its costs.

**Figure 3 Total Cumulative Investments (2020-2030-2050)**



By 2020, total cumulative renewable energy investments will be €963 billion going up to about €1,620 billion by 2030. By 2050, total cumulative renewable energy investments will reach more than €2,800 billion. The important fact to note is that higher upfront investment needs for renewable energy do pay off in the long-run, and for society at large. The capital investment cost will be outweighed by the avoided fossil fuel and CO<sub>2</sub> costs.

It is important to note that the investments done before 2020 and then up to 2030 will have an impact on the years to come as a renewable energy unit installed in a given year will obviously deliver beyond the year it is installed. Hence, expressed in additional cumulative capital requirements, these will increase from about €660 billion in 2030 to more than €1,180 billion in 2050.

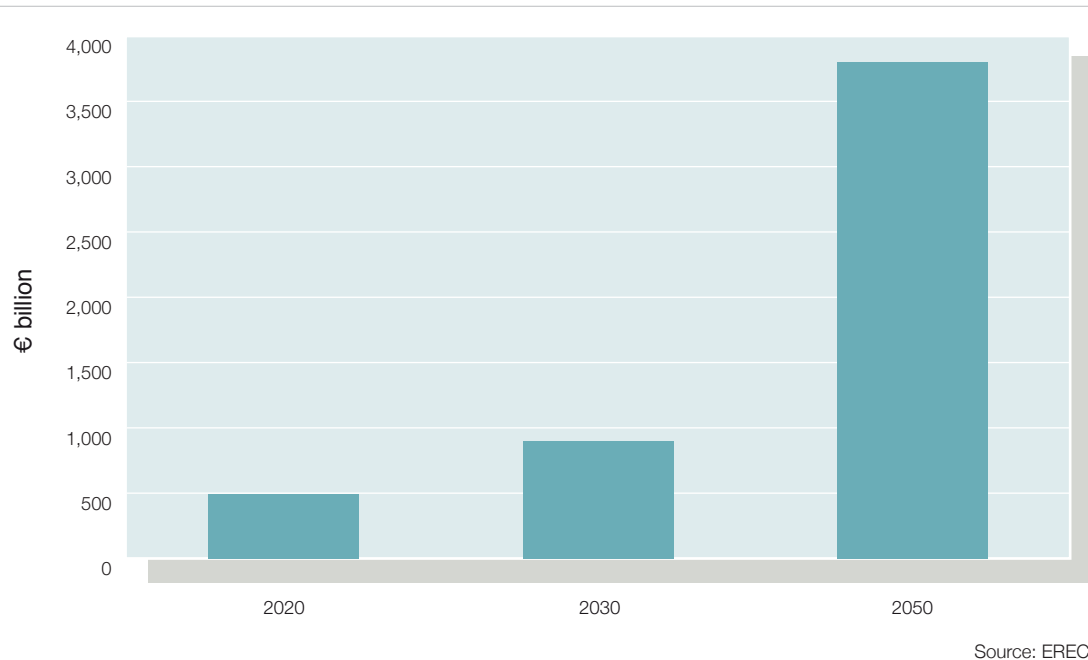
## Environmental Benefits

Renewable energy deployment by 2020 will reduce annual energy related CO<sub>2</sub> emissions by about 1,200 Mt against 1990 emissions, and further by about 2,000 Mt in 2030 and 3,800 Mt in 2050. This equals a CO<sub>2</sub> reduction per annum of 30% in 2020 and about 50% in 2030. By 2050 the EU would be able to reduce its energy related CO<sub>2</sub> emissions by more than 90% compared to 1990 emissions.

The long-term climate protection goal of reducing the EU's emissions by at least 80% domestically should be achieved as efficiently as possible, i.e. at the lowest possible cost. The CO<sub>2</sub> costs avoided due to the use of a particular technology are often consulted to gauge the efficiency of reduction measures.

Considering a CO<sub>2</sub>-price of €41/t in 2020, the additional total CO<sub>2</sub> benefit can be calculated as being about €492 billion (Figure 4). By 2030, assuming a CO<sub>2</sub>-price of €45/t, the benefit would already account for €900 billion, culminating in 2050 at €3,800 billion (or €3.8 trillion), considering a carbon price per ton of €100 in 2050.

**Figure 4 CO<sub>2</sub> Costs Avoided (2020-2030-2050)**



Hence, the CO<sub>2</sub> costs avoided in 2050 due to the deployment of renewable energy technologies already outweigh the cumulative investment of €2,800 billion needed to reach 100% renewable energy in 2050. The economic benefit of investing in renewable energy would therefore amount to €1,000 billion. When taking into account the avoided fossil fuel costs the economic benefit would increase to €2,090 billion in 2050. Therefore, higher upfront investment needs do certainly pay off in the long-run for European citizens.

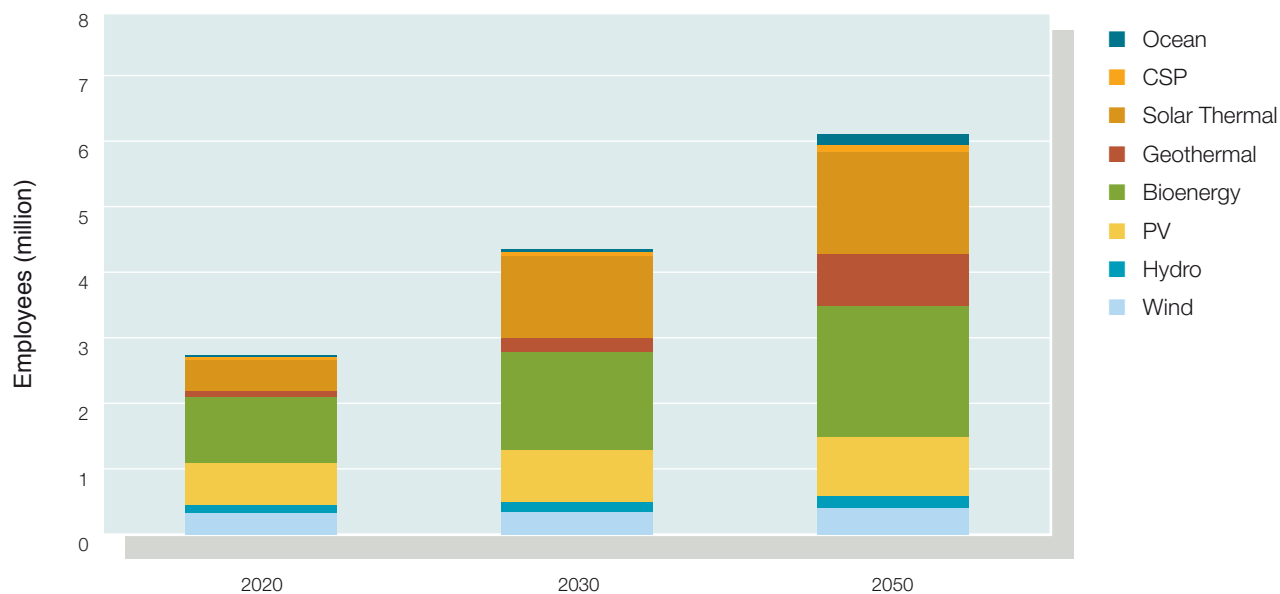
## Social Benefits

Nothing is simple, not least changing our energy system. As the social impact is a core element of moving towards a fully sustainable energy system a strong collaboration between the renewable energy industry and governments as well as local authorities and civil society is needed.

One of the core benefits inherent to an increased deployment of renewable energy technologies is the effect on employment. Renewable energy has a crucial role to play in a sustainable 21<sup>st</sup> century economy through job creation.

By the end of 2009, the renewable energy industry employed over 550,000 people in the European Union. Considering that the pathway set out in *RE-thinking 2050* is followed, the renewable energy sector will employ a total of more than 2.7 million people in 2020 and about 4.4 million in 2030 in the EU alone. This constitutes an average annual increase of gross employment of 36% and 30% respectively compared to 2009. By 2050, employment in the renewable energy sector is expected to exceed the mark of six million, bringing 6.1 million people into work (Figure 5).

**Figure 5 Gross Employment in the Renewable Energy Sector (2020-2030-2050)**



Source: EREC

Furthermore, the potential of renewable energy, as a new industry, to involve the wider public is huge, and by so doing, enriching the knowledge base, and providing energy consumers with the basis on which to build energy responsibility. Last but not least, debates on social acceptance are not new to the energy sector, however, the issue needs to be urgently addressed if policies are to be implemented successfully, as it would be a mistake to assume that as a natural result in the heightened interest in Climate Change, the renewable energy industry can take public support for granted.

## Policy Recommendations – Inventing Tomorrow Today

Continuing on today's energy path without any change in policies would not only mean that the pressing issue of climate change is not addressed, but also that our dependency on fossil fuels is set to increase, and fast, and that we would be bound to unpredictable energy prices, all of which would result in detrimental impacts on Europe's economy and in energy insecurity.

The only way to avoid the ever increasing energy dependence of the European Union is to develop the abundant renewable energy potential of all EU Member States. Europe should lead the way with a clear commitment to a 100% renewable energy future by 2050.

As *RE-thinking 2050* clearly outlines, it is not a matter of availability of technologies. It is a matter of political will and of setting the course today for a sustainable energy future tomorrow. A 100% renewable energy supply for Europe will require paramount changes both in terms of energy production and consumption as well as concerted efforts at all levels – local, regional, national and European.

In order to achieve a 100 % renewable energy supply, a clear-cut and consistent mix of measures must be put in place along the following lines:

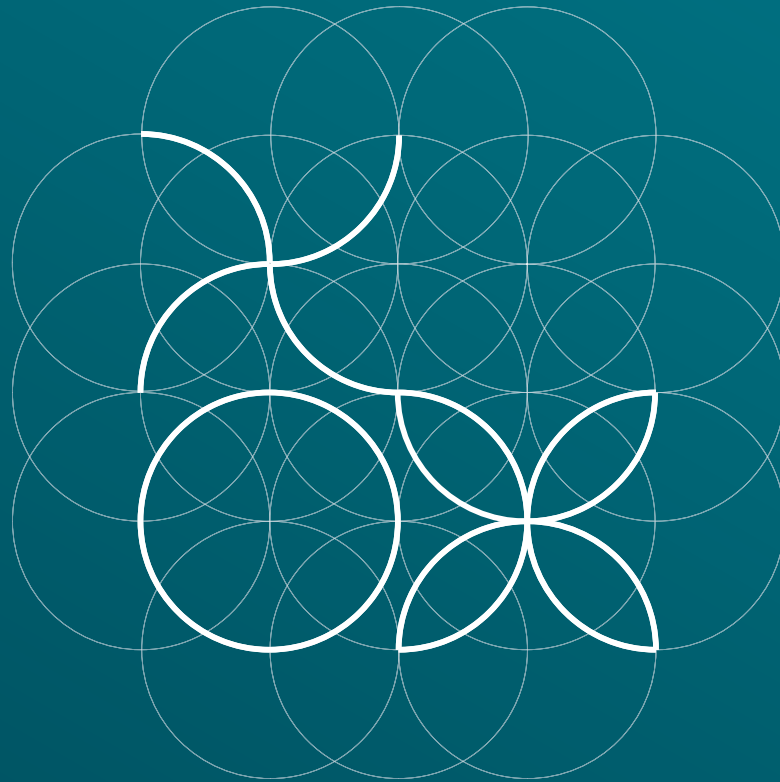
- Supporting the transition towards a 100% renewable energy economy through all EU policy areas
- Less is more – an ambitious energy efficiency and energy savings framework
- Effective and full implementation of the new RES Directive (2009) in all EU-27 Member States
- Binding renewable energy targets for 2030
- Full liberalisation of the energy market
- Phasing out all subsidies for fossil and nuclear energy and introducing an EU-wide carbon tax
- Electricity infrastructure – moving towards SuperSmartGrids
- Hybrid energy solutions and virtual power plants
- Heating and cooling – measures to awaken the sleeping giant
- New transport solutions
- Smart-Energy Cities 2050
- Smart-Energy Buildings 2050 – constructing a better climate

**Be part of a sustainable energy future –  
download the full report of *RE-thinking 2050* & declare your support at:**

**[www.rethinking2050.eu](http://www.rethinking2050.eu)**

EREC, the European Renewable Energy Council, is the umbrella organisation of the major European renewable energy industry, trade and research associations active in the field of photovoltaics, small hydropower, solar thermal, bioenergy, ocean & marine, geothermal, wind energy, and solar thermal electricity. It represents an industry with an annual turnover of more than €70 billion and more than 550,000 employees.





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