



# THE EUROPEAN UNION LEADING IN RENEWABLES



**THE EUROPEAN UNION LEADING IN RENEWABLES**



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## FOREWORD

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*Renewables are a major source of power in the EU, and they are among our best allies for fighting climate change.*

Thousands of delegates from across the world will descend on Paris for the 2015 Climate Conference. Each of them knows how high the stakes are, how tough the negotiations could be and how ambitious the outcome has to be.

Renewable energy will play a leading role in any sustainable and cost-effective solution to climate change. In fact, given that energy and transport account for 80% of EU emissions, climate and energy policies must go hand in hand. That is why as part of its Energy Union the EU has put renewable energy at the heart of its future energy system and this climate agreement.

And we know it works. In one year, renewable energy helped to reduce CO2 emissions in the EU by the equivalent of the annual emissions of Spain<sup>(1)</sup>. Today, I am proud to say that renewables power over 27% of the EU's electricity production<sup>(2)</sup> and account for over 15% of the overall energy share<sup>(3)</sup>.

In 2008, the EU put together a framework for renewable energy based on political objectives and the development of new technologies. This allowed the renewable energy sector to prove its ability to protect our environment by cutting emissions, exploiting local energy sources, and stimulating world-class, high-tech industries.

When it comes to fighting climate change, the boldest measures are the safest. That is why President Juncker made a pledge for Europe to become the world number one in renewable energies. And it's why we have committed to having at least 27% renewables in our energy system by 2030. That ambition and those policies will help us deliver our target to reduce emissions by 40% by 2030.

But renewables are about more than just cutting emissions. They power our economy and fuel our recovery. Over the past five years, the renewable energy sector has provided almost half a million new jobs and now generates around 140 billion euro in turnover – which is a perfect illustration of the fact that it is possible to combine growth and jobs creation with the fight against climate change. That makes the EU a major player on the international market and home to successful clean energy companies, such as the world leader in wind turbine manufacturing. This brochure sets out the five key areas in which the European Union has pioneered renewables. And it shows that we have another world-leading renewable source in Europe: our people, our innovators, our researchers. Thanks to them, with the help of EU policies, the cost of renewables has tumbled and the sector has thrived.

That is why renewable energy has to be at the forefront of all of our minds throughout this conference as we seek a binding, ambitious and global agreement. When the Eiffel Tower was built in 1889 it was only intended to last for 20 years and is still here today. That's a reminder for us all that any climate agreement must stand the test of time.



Miguel Arias Cañete  
Commissioner for Climate Action & Energy

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## INTRODUCTION RENEWABLES AND CLIMATE CHANGE MITIGATION: NO REGRETS

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The EU's economy has grown since 1990 but our emissions of greenhouse gases have fallen – that's thanks to renewable energy and energy efficiency policies. From 1990 to 2014, GDP increased by 46% but total greenhouse gas emissions decreased by over 23%<sup>(4)</sup>. In effect, the EU halved its 'emissions intensity' – the volume of emissions generated per euro of GDP.<sup>(5)</sup>

*GDP increased by **46%**  
but total greenhouse gas emissions  
decreased by **23%***

Today, the emissions intensity of the energy sector in the EU is below the world average<sup>(6)</sup> and it is constantly decreasing.

The rest of the world is now following this trend. In 2014, the world first broke the link between economic and CO<sub>2</sub> growth, due largely to China's increased use of renewable resources, and policies in OECD countries to promote renewable energy and energy efficiency.<sup>(7)</sup>



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**PHOTOVOLTAIC MODULE  
PRICES DROPPED BY 80%  
IN FIVE YEARS**

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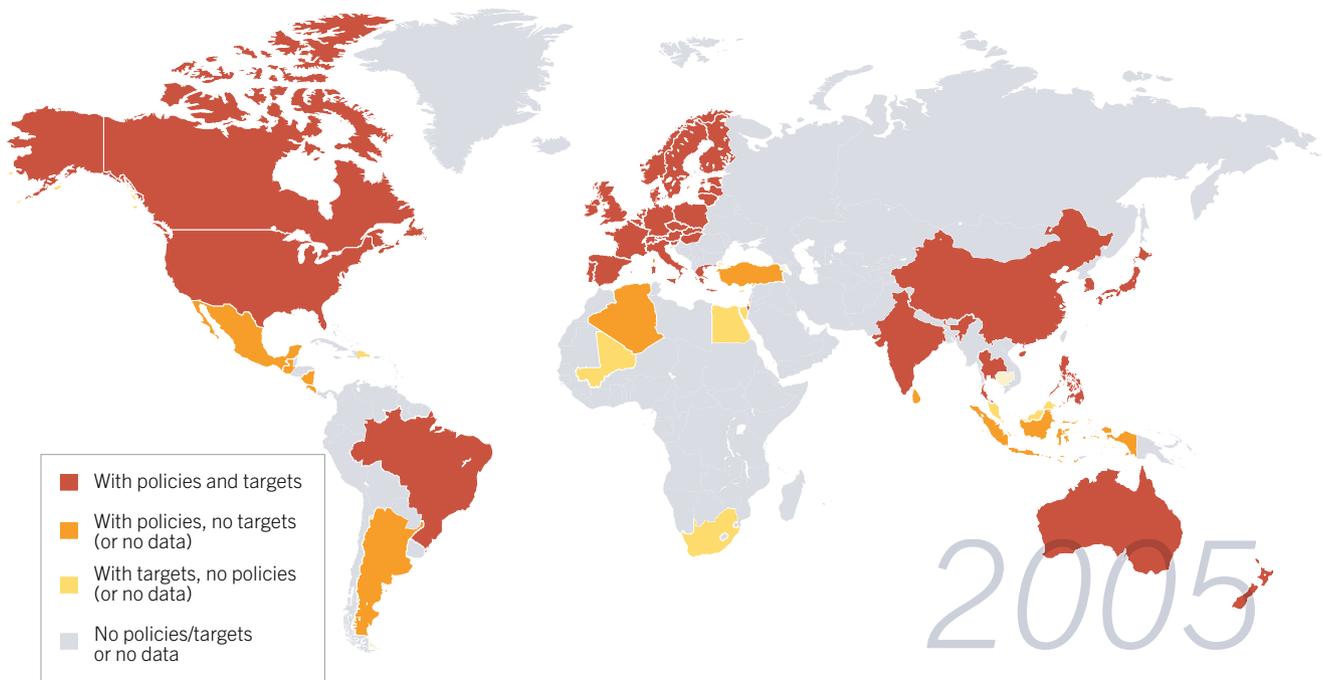


## RENEWABLES IN THE EU AND BEYOND – A SUCCESS STORY

The EU has built global leadership in renewable energy with its ambitious policies and pioneering businesses. Renewables powered almost 15.5% of the EU energy sector in 2014<sup>(8)</sup>, meeting the needs of 78 million Europeans. Today, 27% of the EU's electricity is generated by renewables<sup>(9)</sup>, and this is expected to reach up to 50% by 2030<sup>(10)</sup>. This unprecedented

development of renewables in the EU has dramatically lowered renewable energy costs globally. We have seen an 80% reduction in PV module prices from 2008 to 2012<sup>(11)</sup>. Renewable energy is now becoming cost-competitive, and sometimes even cheaper than some fossil fuels.

### COUNTRIES WITH RENEWABLE ENERGY POLICIES AND TARGETS, 2005



Countries are considered to have policies when at least one national or state/provincial-level policy is in place.

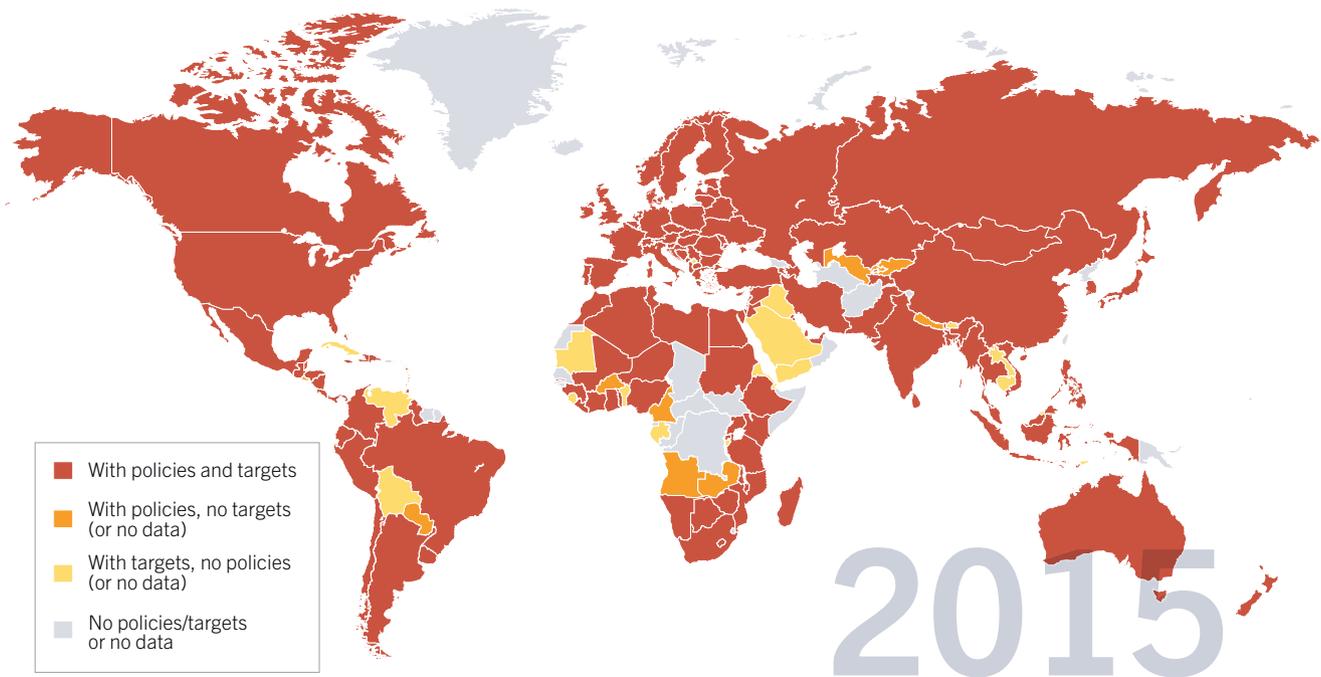
The EU's target to achieve a 20% share of renewable energy by 2020 has been instrumental in delivering this incredible growth and significant cost reductions. Our success has inspired other countries: 164 countries now have renewable energy targets.

Over the last five years, more has been invested in new renewable capacity in the EU than in any other energy sources<sup>(12)</sup>- a trend which is now mirrored around the world.

The International Energy Agency has projected that renewable energy will become the world's number one source of electricity generation by 2035.<sup>(13)</sup>

Renewables are becoming a widely accepted, mainstream source of energy.

### COUNTRIES WITH RENEWABLE ENERGY POLICIES AND TARGETS, EARLY 2015



Countries are considered to have policies when at least one national or state/provincial-level policy is in place.



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# MAKING THE EU WORLD NUMBER ONE IN RENEWABLE ENERGY: THE FIVE KEY AREAS

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# 1. EMPOWERING CITIZENS IS AT THE CORE OF THE ENERGY UNION

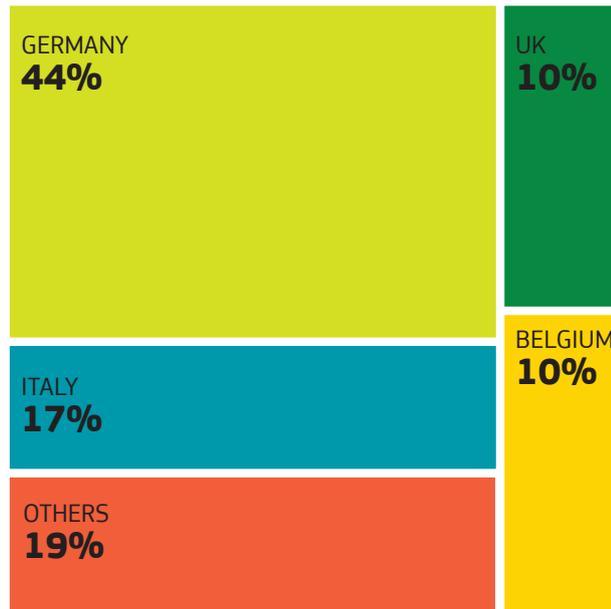
For Europe's ongoing transition to renewable energy to be a success, it must have citizens at its core. Citizens should be able to participate in renewable energy markets, see reductions in their energy bills, produce and consume their own renewable energy. Local and regional authorities are getting involved in renewable energy production, grid expansion projects and their management, and helping to create flexible energy markets locally.

## FACTS AND FIGURES: FOUR WAYS EU CITIZENS PARTICIPATE IN THE ELECTRICITY MARKET

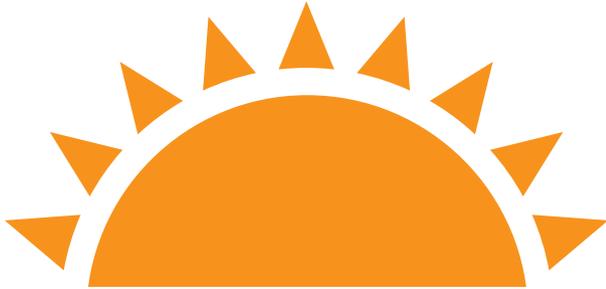
### Getting informed

Every European consumer should be able to know where their energy comes from and decide how they use it. Smart technologies will help consumers make the best energy choices, reduce their bills and take control of how and when they consume energy, and even produce it. Currently, there are more than 60 million electricity smart meters installed in the EU helping consumers make smart energy choices<sup>(14)</sup>. In the future, it is not just metering and billing that will be smart: buildings and homes will be smart too.

### RESIDENTIAL PV CAPACITY SHARES



Source: Bloomberg New Energy Finance, 2014




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## THE EU IS SHINING IN 2014 THE EU HAD **10 TIMES** **MORE RESIDENTIAL SOLAR PANELS** PER CITIZEN THAN THE REST OF THE WORLD

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### Empowering consumers

In Europe, consumers are eager to take part in the energy transition. Local energy communities and cooperatives allow consumers to own renewable energy. Almost 50% of the existing renewable energy capacity in Germany is owned by citizens<sup>(15)</sup>.

### Building smart cities

Cities are key enablers of EU sustainable energy policies. The New Integrated Covenant of Mayors for Climate and Energy gives new climate change-fighting impetus and drive for more renewables to more than 6500 cities representing over 40% of the EU population.

Last year, more than 3000 municipalities committed to sustainable energy action plans. Today 9% of their energy needs are met with locally produced energy, at least 19% of that was renewable<sup>(16)</sup>. The Covenant of Mayors is now active in 55 countries, and is set to expand.

### Home-producing energy

Most EU citizens active in producing renewable energy use solar PV. In 2014, the EU was the world leader in residential PV with more than 40 Watts installed per citizen on average - 10 times more than the rest of the world<sup>(17)</sup>. Italy is a good example of residential PV expansion, with almost 10 times more capacity in the space of just five years<sup>(18)</sup>. The rest of the world is gradually catching up, benefitting from dramatically decreasing prices.

### THE EU IS COMMITTED

The EU supports the empowerment of its citizens in energy, be it through home-producing energy, energy cooperatives or municipal initiatives.

Citizen empowerment starts with better information. Therefore the EU helps to engage consumers by providing information about sustainable energy. This will not only enhance citizens knowledge of renewables, but also improve social acceptance<sup>(19)</sup>.

The new European energy system calls for more energy democracy. The EU is working alongside energy cooperatives to facilitate citizen's ownership of renewables. This is achieved through capacity building, exchange of good practices and financial services.

*The EU is the **world leader** in residential PV with more than **40 W** installed per citizen*

These initiatives are supported by the Horizon 2020 programme. The EU believes that if European citizens want to produce their own energy, they should be encouraged to do so. This energy should be integrated into the system at the lowest possible cost. Therefore the EU is working on making it easier for people to produce and consume their own energy. This is the aim of the «New Deal for Energy Consumers<sup>(20)</sup>» launched in 2015 by the European Commission.

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## 2. BOOSTING ENERGY SECURITY BY PRODUCING LOCALLY

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Renewables made in Europe are a cost-effective way to cut our import bill. Powering electricity, and in particular heating and cooling, with renewables cuts the need for imported fossil fuels reducing our fuel import bill and our vulnerability to supply shocks.

*The EU has cut its demand for fossil fuels by **98 Mtoe** compared to 2005 thanks to renewables*

### FACTS AND FIGURES: DOMESTIC RENEWABLES REDUCED IMPORTS

The EU has cut its demand for fossil fuels by 98 Mtoe compared to 2005 – equivalent to Poland's total energy consumption<sup>(21)</sup> – thanks to rising amounts of renewables.

Without this boost in renewable energy from 2005, the EU's gross inland consumption of fossil fuels would have been 7% higher<sup>(22)</sup> – renewables have saved more than 20 billion euro in fuel costs<sup>(23)</sup>.

Public support for renewables has not only helped lower the cost of renewable technologies, but has also dramatically reduced our import dependency, boosting the economy's growth and energy security.

### THE EU IS COMMITTED

The EU is determined to reinforce its energy security by being more renewable, more efficient and more interconnected. This

energy transition can only be possible in an integrated European energy market which is fit for renewables<sup>(24)</sup>.

A well interconnected European energy grid is a tangible measure of this new market, and is vital for Europe's energy security and the integration of renewables. The EU has agreed that all Member States should reach a 10% electricity interconnection target of their installed electricity production capacity by 2020. This will reach 15% by 2030.

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# RENEWABLES REDUCE THE EU'S DEPENDENCE ON **FOSSIL FUELS**



THEY CUT FOSSIL FUELS USE BY  
THE EQUIVALENT OF **POLAND'S**  
ENTIRE ENERGY CONSUMPTION

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How will the EU achieve this? By identifying priority interconnections, so called Projects of Common Interest (PCI), and supporting the roll-out of these essential infrastructures with financing from the European Fund for Strategic Investments and the Connecting Europe Facility.

The heating and cooling sector has great potential for renewable energy deployment and energy savings. As this sector accounts for almost half of our energy use it is also key to our energy security. The EU is committed to making this sector more efficient and renewable<sup>(25)</sup>.



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### 3. LEADING IN RENEWABLE TECHNOLOGIES AND SYSTEM INTEGRATION

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Being the technological leader for the next generation of renewable energy means unleashing new technological breakthroughs. The EU is determined to develop its world-class engineering competencies, industrial production capabilities and technology supply chains across Europe that can compete globally.

This means creating innovative solutions and services that integrate renewable energy into our grids and market, empower consumers and building flexibility into the system, such as smart, responsive-to-demand grid technologies.

It also includes decarbonising the transport system with new technologies, such as batteries for electric cars and sustainable fuel alternatives for cars, boats and planes.

#### FACTS AND FIGURES: INVESTMENT AND KNOW-HOW

The EU has a structured research and innovation approach to energy – within the framework of the SET-Plan (Strategic Energy Technology Plan<sup>(26)</sup>). Through the identification of strategic priorities and specific actions, supported by collaboration between research institutes, academia and industry, it has been possible to leverage public research funding to deliver dramatic results. Figures are telling: in one year, the total investment in Europe for research and innovation in four renewable energy technologies was around 3.8 billion euro. The EU contribution stimulated 1 billion euro from national budgets<sup>(27)</sup> and 2.6 billion euro from corporate funding<sup>(28)</sup>.

Today European companies hold 40% of all patents for renewable technologies<sup>(29)</sup> and are leading in key sectors:

- Offshore wind, with 43% of all wind turbines in the world produced by a few major European manufacturers;
- Ocean energy, with 460 MW of new ocean energy projects to be deployed over the next three years in Europe;
- Concentrated Solar Power, with EU entities involved in the majority of the projects developed so far worldwide, and an ambitious EU industry cost reduction target by 2020.

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**EUROPE**  
**INVESTS IN R&I**  
**FOR RENEWABLES**  
  
**€4 BILLION**  
**A YEAR**

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### THE EU IS COMMITTED

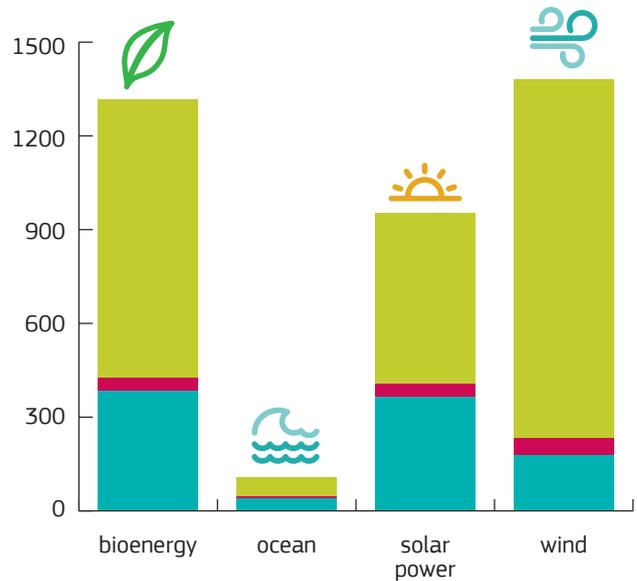
This year the EU put a new plan in place to further spur R&I and quicken cost reductions. For this, the European Commission proposed ten focused research and innovation actions to accelerate the energy system's transformation and create jobs and growth, ensuring the European Union's leadership in the development and deployment of low-carbon energy technologies.

*European companies hold **40%** of all patents for renewable technologies*

These pledges are described in the SET-Plan.<sup>(30)</sup>

Concrete action areas and projects are also included in the Horizon 2020 programme: smart grids, energy storage and system integration, solar photovoltaics, wind energy, and ocean technologies will be part of our future and are supported today.

### RENEWABLE ENERGY R&D INVESTMENT IN EUROPE (Million €)



- Corporate R&D Investment
- Public funding available at EU level (indicative)
- Public funding available through national mechanisms (EU, NO & CH)

*Source: Based on JRC, Capacity Mapping: R&D investment in SET-Plan technologies, 2015. Absolute contribution of national, EU and corporate funding to R&D (data from 2011)*

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## 4. ROLLING OUT RENEWABLES INSIDE THE EU

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A solid renewable deployment means a stronger industry and lower technology costs. Crucially, low-cost financing for capital intensive renewables hinges on a stable investment environment and a market that reduces red tape and risk.

### FACTS AND FIGURES: RENEWABLE ENERGY FOR ALL USES

Renewables account for almost 15.5% of the EU's final energy consumption<sup>(31)</sup>. Around 26% of the EU's electricity, 17% of the EU heating and cooling sector and 6% of EU transport energy we use are renewable<sup>(32)</sup>. Nearly half of our energy is used for

heating and cooling, hence the importance of making this sector more renewable.

Europe is a world leader in renewables. Currently, there is around 3 times more renewable power installed per person in the EU than the world average<sup>(33)</sup>. As the share continues to climb, renewable energy becomes increasingly cost-competitive, and sometimes even cheaper than some fossil fuels<sup>(34)</sup>.

Europe is strong on global markets. In wind energy, the EU is a major player with four European companies, including the world number one, in the top ten of the world's wind turbine manufacturers<sup>(35)</sup>.

### THE EU IS COMMITTED

The EU's renewable energy targets for 2020 have created a steady demand for cost-effective renewable technology. Last year the European Council<sup>(36)</sup> agreed an EU-level binding target of at least 27% renewables by 2030, which will continue the steady roll out of renewables in the EU economy. The Commission is now working on a post-2020 renewables package that will ensure we hit this target in a sustainable and cost-efficient way.

The EU is also adjusting the electricity market to enable the integration of renewable energy and create a level playing field where conventional and renewable energy technologies can compete on an equal footing.

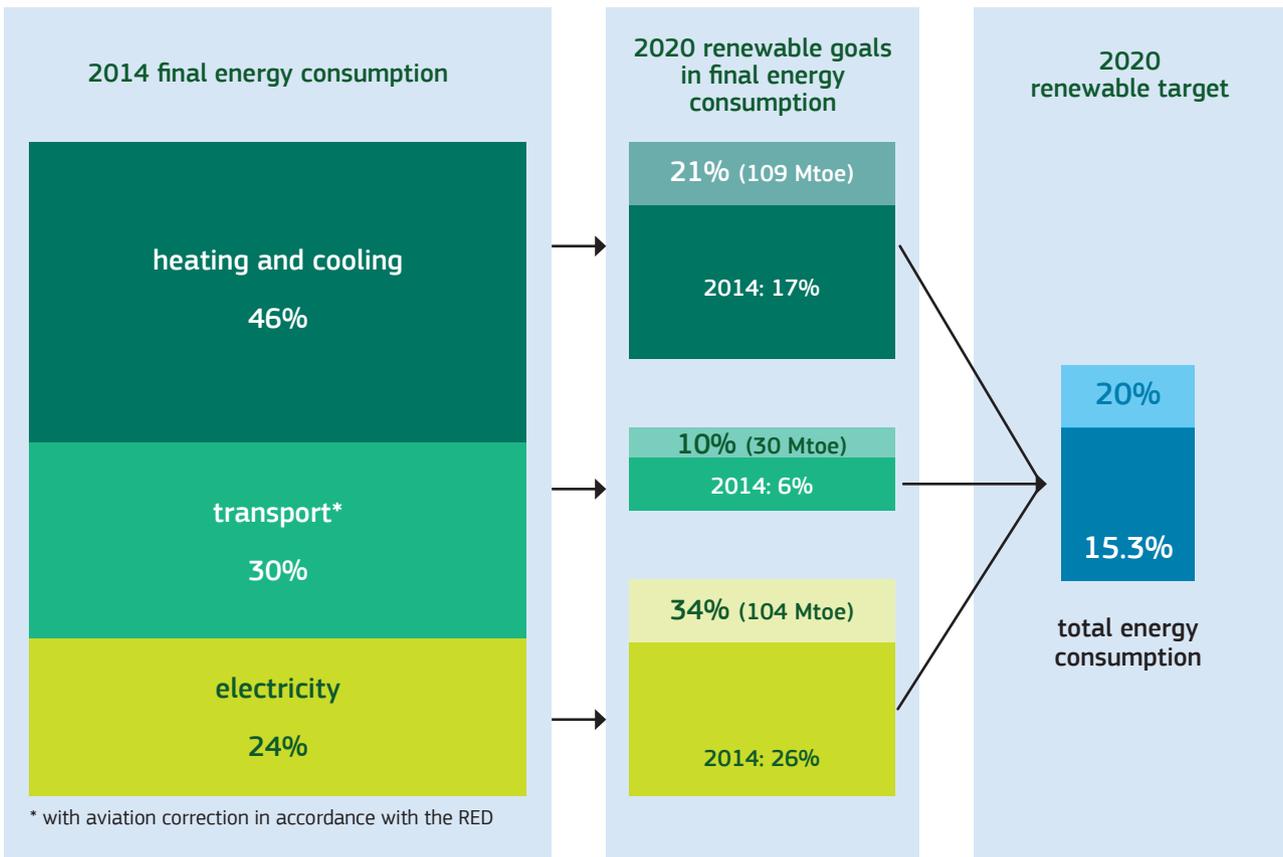
The Commission will seek to make effective use of its own funds under the newly-created European Fund for Strategic Investments (EFSI), and in particular through innovative financial instruments.



**3 times** more renewable power installed per person in the EU than the world average

Finally, European Structural and Investment Funds (ESIF)<sup>(37)</sup> provide important financial support and key enabling conditions, such as capacity building, technical assistance and cross border cooperation possibilities, for the shift towards a low-carbon economy. About 45 billion euro<sup>(38)</sup> is allocated over the 2014-2020 period mainly for investments in sustainable energy and multi-modal urban transport. These include investments in renewable energy.

**FINAL ENERGY CONSUMPTION IN EUROPE BY SECTOR WITH RENEWABLE ENERGY SHARES IN 2014 AGAINST 2020 TARGETS**



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## 5. MAINTAINING AND CREATING SUSTAINABLE JOBS AND ADDED VALUE

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Policies that create growth and jobs are at the centre of the policy agenda of the Juncker Commission. A strong renewable policy will enable Europe to fully reap all the benefits of the energy transition and contribute to sustainable growth, jobs and exports; not only in the renewables sector, but in the whole economy.

### FACTS AND FIGURES: SUSTAINABLE JOBS, GROWTH

The European renewable energy sector employs 1.15 million people<sup>(39)</sup>, representing over 2 renewable energy related jobs per 1000 inhabitants, which is twice the world average<sup>(40)</sup>. Renewable energy is even one of the few sectors where employment has grown in spite of the financial crisis, with almost half a million additional jobs between 2008 and 2013<sup>(41)</sup>.

*The European renewable energy sector employs **1.15 million** people*

Renewable energy technologies usually create more jobs than conventional technologies for each energy unit generated. More renewables means more jobs, with new types of jobs and skill requirements, especially in the power sector<sup>(42)</sup>. Solar PV installers, experts in smart home solutions, district heating workers, energy advisors, will be key to our future energy

system. Europe needs to be ready for the transition, through training and education, and in creating jobs in research and engineering<sup>(43)</sup>.

Europe is equally a leader in the turnover of renewable energy companies. In 2013, the renewable sector generated 137 billion euro in turnover, with a 6% increase on the previous year<sup>(44)</sup>.

### THE EU IS COMMITTED

The construction sector is at the forefront of the energy transition. Therefore the EU continuously supports the adaptation of jobs and skills to sustainable energy needs under



the Horizon 2020 programme<sup>(45)</sup>. The EU aims to improve the skills of middle and senior level professionals and workers throughout the entire value chain of the construction of new buildings and building renovation. This anticipates our ambition, in the view of achieving nearly zero energy levels, including on-site renewable energy generation.

The EU also works alongside its social partners to build together a smarter, more sustainable, and more inclusive working environment which can think ahead the new energy challenges. The European Social Fund also helps by supporting a transition of the labour force to incorporate greener skills and address skill shortages, including those in the energy efficiency, renewable energy and sustainable transport sectors.

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**RENEWABLES  
CREATE EUROPEAN JOBS**



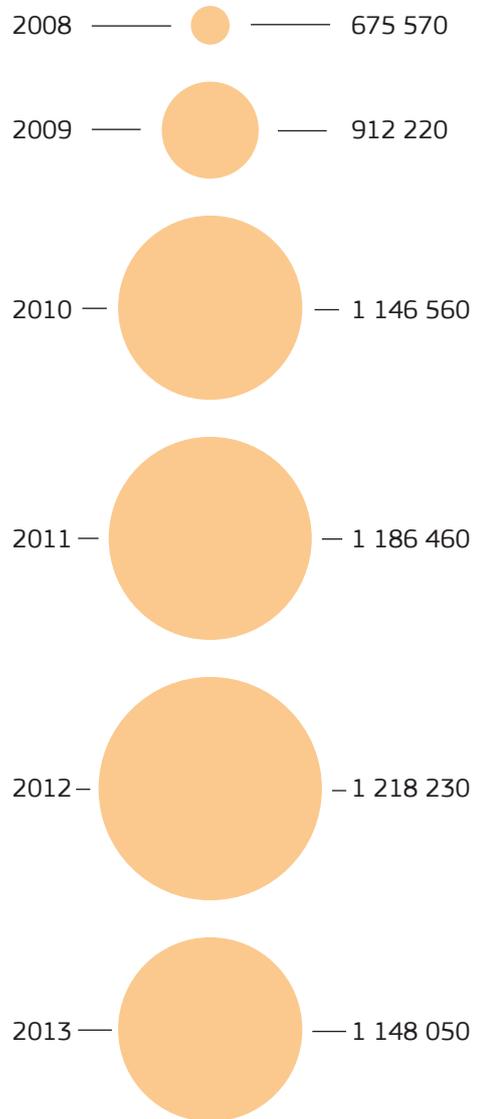
**MORE THAN 1 MILLION  
EUROPEANS WORK  
IN THE SECTOR**



**THIS IS TWICE THE WORLD  
AVERAGE PER CAPITA**

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**EMPLOYMENT OF ALL RENEWABLE ENERGY  
SECTORS IN EU-27**



Source: EurObserv'ER database, both direct and indirect jobs

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## CONCLUSIONS AND NEXT STEPS

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Europe has long been home to the world's renewable energy pioneers. In 1876, Augustin Mouchot unveiled his ground-breaking solar powered steam engine to the amazement of the delegates at the World Exposition in Paris. Almost 140 years on, in the very same city, the world will come together to take a united stand against climate change.

As we do that we should take inspiration from the likes of Mouchot and remind ourselves of one thing: the fight against climate change will never be won by taking the line of least resistance. Being cautious is too risky at this stage and that is why the EU must continue to enable its world-pioneering energy deployment.

This brochure shows how far the EU has come thanks to the Energy Union and its drive for a low-carbon economy. It is imperative that we capitalise on that because renewables will be key to reaching our 2030 decarbonisation and climate goals. That is why the EU has firmly committed to having at least 27% of renewables in its energy system by 2030.

But being ambitious is easy on paper. We now need to make that a reality. So what is the EU doing to make sure we back up our words?

The European Commission and EU Member States have committed to the Lima-Paris Action Agenda by putting citizens and local stakeholders at the core of the transformation of the energy system. The Commission's new electricity market design proposals, and its support for new technological innovation will help to create the right conditions to turn ambition into reality.

But to support that the European Union will also need to ally with the worldwide energy market. The European Commission is committed to proactively working with its international partners to support the rapid deployment of renewable energy around the world. The European Commission will pursue this objective and the implementation of the COP21's agreement into concrete policies, alongside its G7 and G20 partners, the International Renewable Energy Agency (IRENA) and the International Energy Agency (IEA).

In this brochure the European Commission has outlined a five-point template for achieving world leadership in renewables. As the pioneer Augustin Mouchot did in the past, the Commission hopes its actions will inspire the regions of the world to make the renewable energy transition a worldwide reality.



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## ANNEX – REFERENCES

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(38) Data based on adopted or draft operational programmes as of October 2015

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