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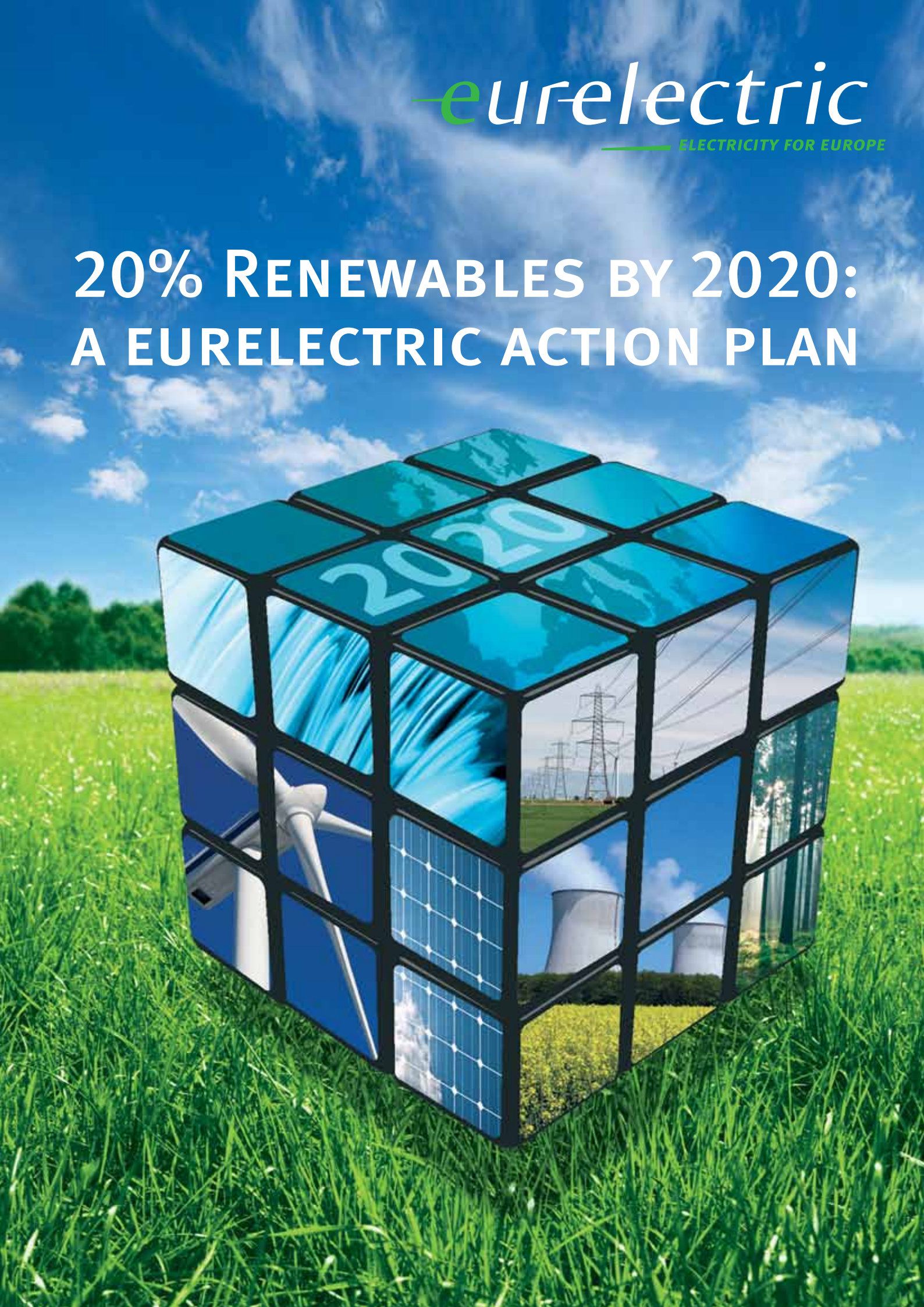
ELECTRICITY FOR EUROPE

20% Renewables by 2020: a Eurelectric action plan



This report is part of the EURELECTRIC Renewables Action Plan (RESAP).

The electricity industry is an important investor in renewable energy sources (RES) in Europe. For instance, it is responsible for 40% of all wind onshore investments. RES generation already represents a substantial share in the power mix and will continue to increase in the coming years.

EURELECTRIC's Renewables Action Plan (RESAP) was launched in spring 2010 to develop a comprehensive industry strategy on renewables development in Europe.

RESAP addresses the following key challenges in promoting RES generation:
- the need for a system approach to flexibility and back-up,
- the need for a market-driven approach,
- the need for a European approach to RES development.

RESAP consists of 14 dedicated task forces, including demand side management, market design, load and storage. The purpose of RESAP is to develop, through a series of reports and a final synopsis report, sound analysis with key recommendations for policymakers and industry experts.

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20% RENEWABLES BY 2020: A EURELECTRIC ACTION PLAN

RESAP Coordination Group

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The Renewables Action Plan is the electricity industry's proactive response to the 20% RES target for 2020.

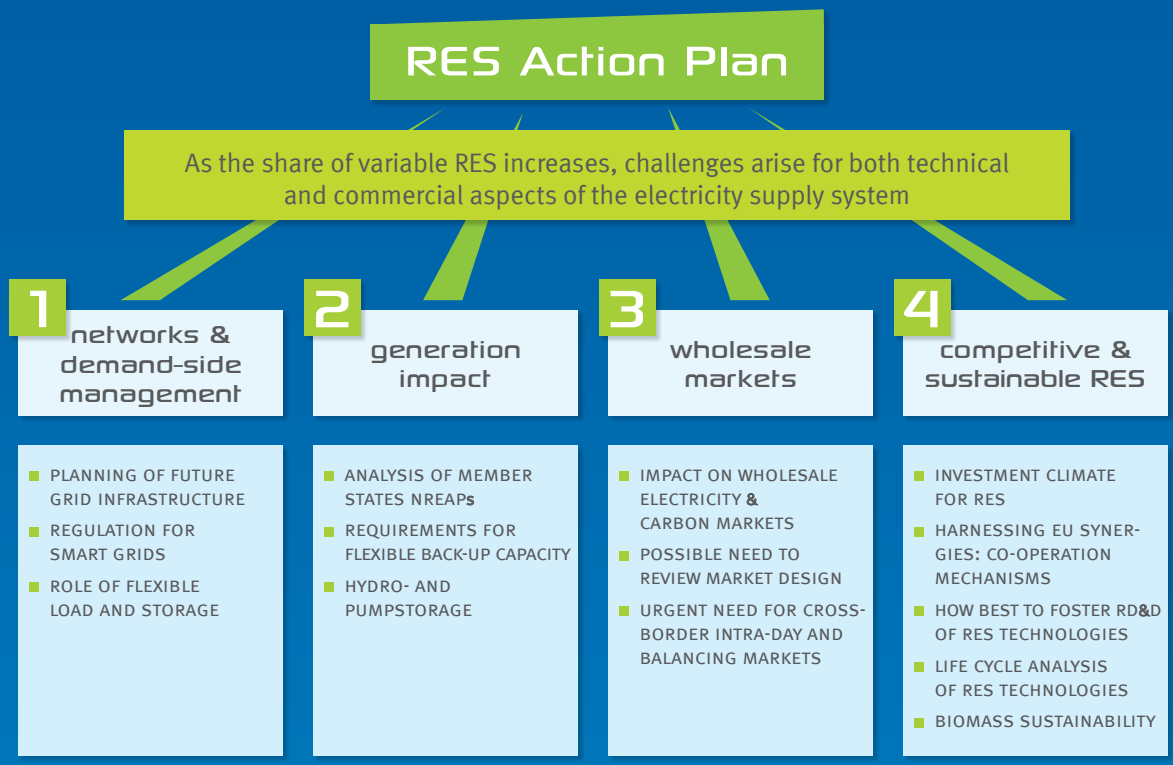
In spring 2010, EURELECTRIC launched work on its ***Renewables Action Plan*** (RESAP).

The purpose: to develop a comprehensive industry strategy on renewables development in Europe, in order to reach the EU's 20% renewables target.

RESAP has been developed as a way to highlight the industry's commitment to renewables. The European electricity sector is and will remain a major investor in renewable energy sources (RES) in the coming decade. This report addresses the 20% RES target for 2020 in final energy consumption – a figure which requires almost 35% of renewables in the electricity mix.

RESAP is based on four main blocks, covering the whole electricity value chain – Networks, Generation, Markets, and Competitive and Sustainable Renewables – and a series of tasks, managed by a Steering Group and a Coordination Group and involving experts, associations and companies across EURELECTRIC's whole structure of expertise.

EURELECTRIC would like to pay tribute to all members who have participated actively in the RESAP task forces, and especially to Oluf Ulseth, CEO of Energy Norway, who has been coordinating this demanding common project on behalf of the Board.



Outcomes and recommendations are summarised in this synopsis report. They are aimed at ensuring that the RES target is achieved effectively in order to minimise costs to consumers. An overview of all RESAP reports and recommendations can be found at the end of this report.

For more information please visit: *http://www.eurelectric.org/RESAP*

Challenges, principles and key recommendations

Challenges

To reach the EU's 20% RES target by 2020, about one third of the EU's electricity will need to be generated from renewable energy sources (RES). RES cover a variety of more than ten different technologies with different characteristics – some variable, others not – and all on different tracks to grid parity. The take-off of technologies such as wind and solar will transform Europe's energy system, networks and markets. It represents a key investment opportunity for the power sector but will also pose unique challenges to the energy system.

EU electricity markets and utilities are experiencing fundamental change as a result of the EU's policy goals, especially the targets for 20% greenhouse gas reduction and 20% renewable energy by 2020. Fostered by national government support programmes and by EU legislation, new RES technologies have increasingly been deployed since the early Nineties. In the same period, electricity generated from renewables has continued to grow, reaching about 597.6 TWh in 2009.[1]

Society places a high value on reliable and affordable supplies of electricity. It is important that the increase in RES production, particularly from variable and non-dispatchable sources, is achieved without adverse effects on security of supply and at reasonable cost. The power system as a whole must therefore adapt to these changing conditions.

Given the task ahead, the objective of RESAP is to set out how to deliver on these ambitious targets for renewable energy. At the same time we are determined to make this change so that it leads to a carbon-neutral future by 2050.[2]

[1] *Source: EURELECTRIC Power Statistics 2010.*

[2] *In March 2009, electricity sector Chief Executives from 61 power companies in 27 countries jointly producing 2,500 TWh electricity per year, equivalent to over 70% of total European power generation, committed themselves to achieve a carbon-neutral power supply by 2050, work for an integrated European electricity market that will deliver power cost-efficiently and reliably, and promote energy-efficient electricity applications as a key part of the solution to the energy-climate challenge.*

Principles

For EURELECTRIC, the three following principles should be the basis for meeting these challenges:

- **A European approach to policy and markets.** In well-functioning markets, effective companies thrive and innovation is rewarded. However, a multitude of competing and conflicting European and national policies and targets will increase risks, costs and administrative burdens. To ensure that investments and integration of renewables are optimised, a consistent European approach to policies and to markets is necessary.

- **A system approach to managing variability.** Delivering on renewables will require adapting and developing the entire energy system. Managing increased variability calls for flexible and back-up generation capacity, integrated wholesale markets, storage, smart grids and demand-side participation, as well as a solid infrastructure at transmission and distribution level. Policymakers must therefore adopt a holistic system approach.

- **Electricity is an indispensable part of the low-carbon future.** The growth in renewables is one part of a major shift aimed at reducing emissions from the power sector. In a long-term perspective energy needs will increasingly have to be met through zero or very low-carbon energy sources. Increased electrification will therefore be needed to replace direct fossil fuel use in heating, cooling and transport. More renewable energy will be needed to fuel this drive for electrification on the way to a carbon-neutral energy system.

Toolbox for Policymakers: Action Now!

To achieve the 2020 20% RES target and move towards carbon-neutral electricity in 2050, EURELECTRIC urges national and European policymakers and regulators to focus on the following key actions.

1. **Successful growth in renewable energy depends on a well-functioning and integrated European energy market.**
2. **Obstacles for investments in renewables and grid infrastructure must be removed.**
3. **Flexibility on both the demand and the supply side should be promoted through a consistent policy framework.**
4. **Use of co-operation mechanisms and progressive convergence of support schemes for RES must be incentivised.**
5. **A long-term RES policy must build on the EU ETS as a key driver of cost-effective decarbonisation.**

Key Recommendations for Policymakers

1 Successful growth in renewable energy depends on a well-functioning and integrated European energy market.

- Policymakers must focus on the entire value chain needed to achieve Europe's renewables and low-carbon objectives. Back-up generation, grid development, demand-side participation, storage and market integration will have to play a major role.
- Market integration tools such as day-ahead market coupling, cross-border intraday and cross-border balancing markets are indispensable in ensuring and facilitating the contribution of all available flexible generation and demand sources.

2 Obstacles for investments in renewables and grid infrastructure must be removed.

- Removing administrative and planning barriers to renewables and the accompanying infrastructure will be decisive to reach agreed targets.
- A stable, competitive and positive investment climate will be needed to ensure continuing large-scale investment in renewables.
- A more consistent and stable policy framework should be developed, through aligning the conflicting objectives of European energy, environmental and climate policies, as exemplified by the Water Framework Directive[3], the Eco-Design Directive and the proposed Energy Efficiency Directive. In addition, national interpretations of EU environmental legislation can be a significant barrier to the planning and permitting of new infrastructure.
- The primary energy based target methodology used by the European Commission in the proposed Energy Efficiency and Eco-Design Directives has to be reconsidered as it has adverse effects and trade-offs with the RES target: it may significantly curtail the growth of biomass and other RES technologies.
- Mandatory EU-wide sustainability criteria for biomass are required to guarantee the sustainability of biomass.
- Urgent and extensive grid investments – on the transmission as well as the distribution side – are needed to increase interconnection capacities, remove internal bottlenecks and develop offshore grids while enabling distribution grids to accommodate growing shares of decentralised renewable energy production.

3 Flexibility on both the supply and the demand side should be promoted through a consistent policy framework.

On the supply side:

- Electricity market designs must ensure the existence of correct price signals to allow markets to function and incentivise the necessary investment in flexible and back-up generation capacity.
- Market players should be able to trade close to real time in integrated intraday and balancing markets, allowing them to adapt to unforeseen deviations of variable generation from day-ahead forecasts.
- Steps should be taken to exploit the remaining potential for hydropower and pumped storage as well as combined cycle gas turbine plant. These are a key element in the new back-up and storage system, both up to and beyond 2020. In addition the grids have to be developed in order to allow the use of hydropower potential on a European, not a national scale.

[3] *The implementation of the Water Framework Directive may significantly reduce the capacity of hydropower plants therefore limiting their contribution of the necessary back-up power. This should be addressed in the European Commission's 2012 water policy blueprint and the review of the directive in 2014.*

On the demand side:

- Retail markets need to be able to deliver attractive products and services based on correct price signals, which can be achieved for example by removing regulated wholesale and end-user prices.
- Regulatory incentives are needed that encourage distribution system operators (DSOs) to invest in a smarter distribution grid, including innovative and ICT-based investments. Regulators should thus allow enough commercial space for investment in future technologies that can improve the networks. Economic regulation models should be revised at member state level to foster the implementation of smart grids.
- A clear market model for smart grids and demand-side participation should be developed. This model should clarify the roles and responsibilities as well as the interactions between suppliers and DSOs. DSOs should be responsible for the roll-out of smart meters and it has to be defined how the costs of this roll-out should be recovered.

4 Use of co-operation mechanisms and progressive convergence of support schemes for RES must be incentivised to ensure cost-effectiveness and to establish a European level playing field.

- Support schemes should be transparent to customers, who will in any event be required to fund the additional costs via taxes or through increased consumer prices. Such schemes should be – at least partly – exposed to the price dynamics of supply and demand.
- A better coordination of national policies should promote the most cost-effective renewables projects across Europe. The common certificate scheme between Norway and Sweden can be considered as a benchmark. A regional approach makes sense, and nearby geographical regions should take advantage of this in order to ensure maximum economic efficiency.
- The national RES plans show a clear lack of intention to use the co-operation mechanisms, which the European Commission has stated are essential for achieving the 20% RES target. The EU has to establish a strengthened framework for use of co-operation mechanisms.

5 A long-term policy on renewables must be based on the EU ETS as a key driver of cost-effective decarbonisation.

- Clarity on the long-term perspective of the renewables regulatory framework will represent an important contribution to reaching the 2020 targets.
- The EU ETS is the major policy instrument on decarbonisation at the EU level, in contrast to EU policies executed through national approaches on RES and energy efficiency. In a perspective covering 2020 and beyond, it should be used to allow those policies to converge. It would allow for achieving a consistent and economically efficient approach to decarbonisation, while facilitating affordability and security of supply.
- In the longer term, as RES close the cost gap with other technologies, the EU ETS should be the key driver through putting a long-term price on emissions. RES generation technologies should be progressively integrated into the market, allowing them to compete on a level playing field with all other generation sources.

THE EUROPEAN ELECTRICITY INDUSTRY IS A MAJOR INVESTOR IN ELECTRICITY GENERATION FROM RENEWABLES - TODAY AND TOMORROW

Renewables will represent a significantly increasing share of generation technologies in the electricity mix, more than doubling over the next ten years. The 2009 Renewables Directive sets a 20% target for RES in total energy consumption by 2020, rising from a 2005 level of around 8%. The target is calculated as a percentage of total final energy consumption, including all energy use – electricity, heating & cooling and transport. Depending on the scenario, the overall 20% target will require RES to deliver almost 35% in electricity.

The increasing capital, competence and market knowledge required to succeed in technologies generating electricity from renewables have also strengthened the role of the electricity industry, which has become the key industrial driver in this development. According to EURELECTRIC *Power Statistics 2010* renewable energy is the largest area for investment in terms of capacity. In 2009 alone, an additional 10.2 GW of wind and 5.8 GW of photovoltaic have been set up.[4] The electricity industry represented by EURELECTRIC is not only investing in the most mature RES technologies such as onshore wind. They are also leading industrial investors in offshore wind projects, which are very capital-intensive and technically challenging. Today's major projects of wind offshore development include Greater Gabbard, London Array and Dogger Bank.

[4] *Source: Eurostat.*

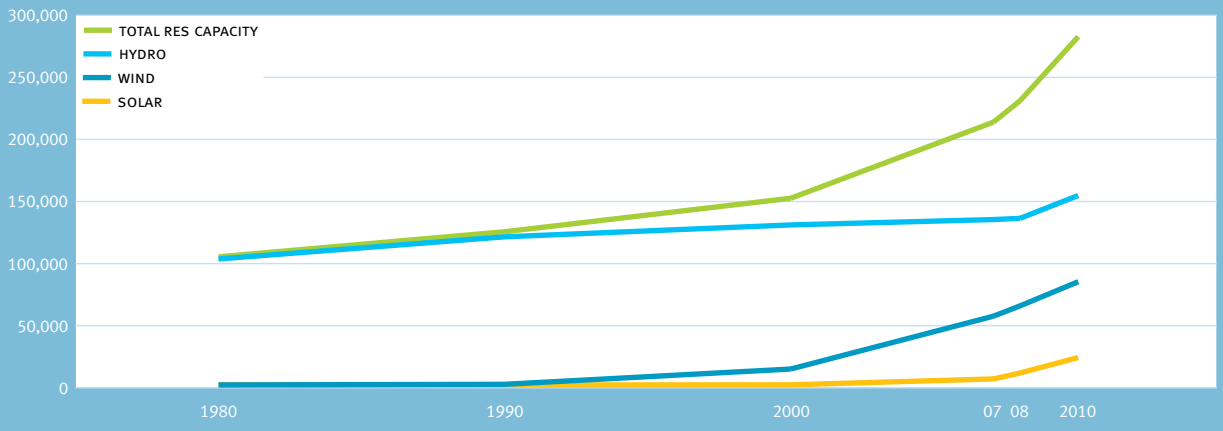
Table 1: RES Generating Capacity built by the industry represented by EURELECTRIC, 1980-2010 (EU-27 plus Switzerland and Norway)

MAX NET GENERATING CAPACITY BY TYPE OF ENERGY (MW)						
	1980	1990	2000	2007	2008	2010
Hydro (excluding pumped)	101,589	119,317	128,875	133,182	134,162	152,464
Solar	0	4	90	4,818	10,176	22,588
Geothermal	432	502	604	698	702	706
Wind	4	502	12,747	55,731	64,013	83,355
Biogas	0	230	991	3,360	3,860	3,681
Biomass	932	1,448	3,160	9,180	9,711	12,208
Waste	5	746	3,152	3,968	5,679	4,529
Other (Wave/Tidal etc)	354	453	649	324	169	222
TOTAL RES CAPACITY (incl. hydro)	103,316	123,382	150,268	211,262	228,472	279,753

Source: EURELECTRIC Power Statistics 2011 (data for hydro power from 2010 in Power eTrack)

The table above shows the huge increase in RES capacity resulting from the investment carried out by the industry represented by EURELECTRIC. At the same time it shows the important proportion of variable RES sources like wind and solar within this share. Based on this table, Figure 1 below charts the development of wind, solar and hydro as a share of total RES capacity.

Figure 1: Development of RES capacity



Source: EURELECTRIC Power Statistics 2011

Table 2 below compares historical EUROSTAT data for renewable electricity generation with the projections in the National Renewable Energy Action Plans (NREAPs) for 2020. Very strong growth rates for RES technologies were seen in the period 2000-2008, but at this time renewables were growing from a very low base. In the 2008-2020 period, rather strong growth rates must be maintained to reach the ambitions of the national action plans but the comparison is notably more challenging in absolute terms – just over 50 TWh of new RES generation must be produced each year from 2008 to 2020, compared to just over 20 TWh of new generation added each year from 2000 to 2008.

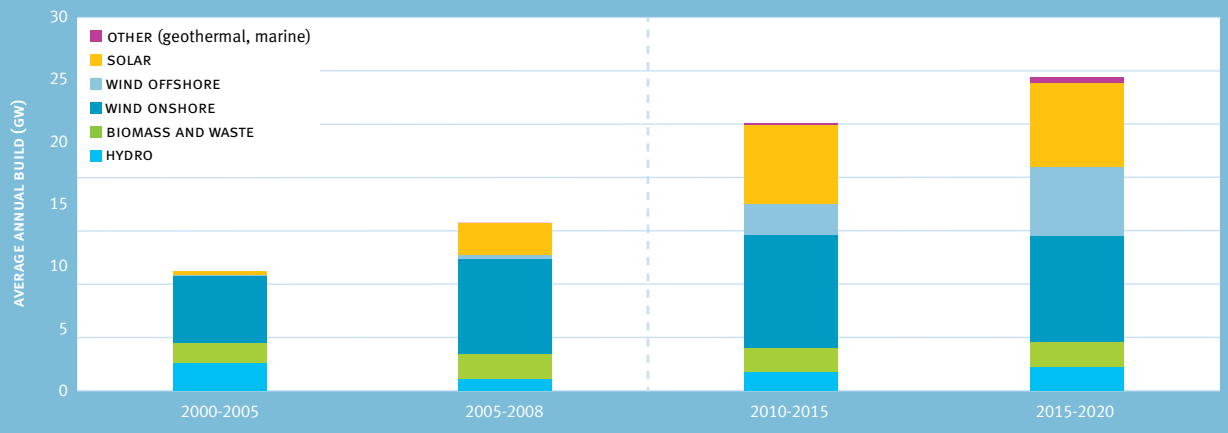
Table 2: Comparison of RES production data and growth rates between historical reference period (2000-2008, data from EUROSTAT) and projections from NREAPs to meet the 2020 target (for EU-27 only)

Gross Electricity Generation	2000	2008	2020	Actual Growth Rate 2000-2008	Required growth rate 2008-2020 to reach NREAP
TWh	Actual data: EUROSTAT	Actual data: EUROSTAT	Projection from NREAPs		
Hydro	352.5	359.2	370.0	0.2%	0.2%
Biomass	40.5	107.9	232.0	13.0%	6.6%
Wind	22.3	118.7	495.0	23.2%	12.6%
Solar	0.1	7.4	103.0	71.3%	24.5%
Geothermal / Other	4.8	5.7	17.0	2.2%	9.5%
TOTAL RES-Electricity generation	420.2	598.9	1217.0	4.5%	6.1%
% SHARE RES-E IN ELECTRICITY CONSUMPTION	13.8%	16.7%	34.5%		

Source: EURELECTRIC, from Eurostat and NREAP data, 2011

Figure 2 below shows the annual new build of RES historically (until 2008) and that required up until 2020 in order to fulfil the NREAPs. This indicates that the key challenge is to increase offshore wind and solar capacity, for which annual build rates must go up exponentially in order to reach the 2020 target in accordance with the NREAPs.

Figure 2: Average annual new build of renewables



Source: Historical data from Eurostat; 2010 onwards according to National Renewable Energy Action Plans

A SYSTEM APPROACH TO MANAGING VARIABILITY IS NEEDED FOR THE CONTINUED GROWTH OF RENEWABLES IN EUROPE

Some renewable sources such as biomass are dispatchable and can play a useful role in helping to meet fluctuating and peak demand. However, if Europe is to meet its RES targets, variable sources such as wind and solar will have to play a major role. According to the National Renewable Energy Action Plans (NREAPs) the share of RES for electricity generation will be 34.5% in 2020. Variability at unprecedented levels will therefore have to be managed, with major implications for all generation technologies, transmission and distribution grids, energy markets and end-users. We therefore need to adopt a system approach to RES that considers all those elements and also the timelines when each element can deliver. A large and growing share of renewable energy in the generation mix can only be delivered if all the elements are in place. This calls for a wider approach on policy measures on how to deliver ambitious RES targets.

Special emphasis should be placed on European countries which do not have strong interconnections with the transmission grids of Central Europe. Additional investments are needed to strengthen these interconnections, resulting in a strong need to focus on the special requirements (technical, economic, etc.) for these countries.

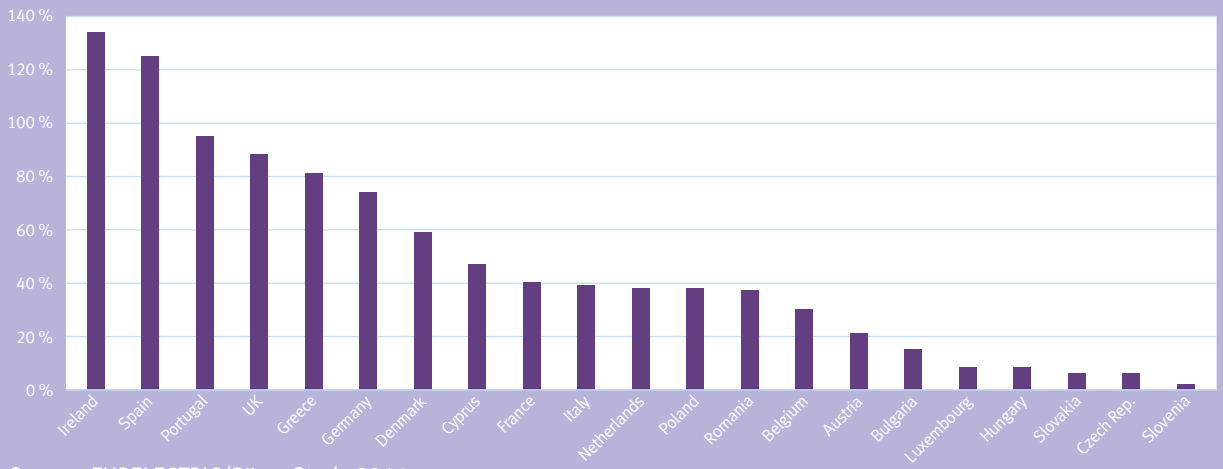
The following figures illustrate the challenge. Figure 3 indicates wind capacity as a percentage of average minimum overnight demand in summer 2020, whilst Figure 4 indicates the same comparison for solar capacity against average demand. Figure 3 shows that the most acute problem is created by wind power, for which capacity is likely to be in excess of 100% of overnight summer demand in Ireland and Spain. The challenge is also very significant for Portugal, the UK, Greece, Germany and Denmark. For solar, Germany or Italy face the greatest challenge in system management. Figure 5 gives an example of the Spanish system to illustrate what such a quantity of variable generation sources requires as flexible back-up from other types of generation.

[5] *For wind power, the measure against overnight demand is appropriate as strong winds can occur at night – at the same time as lowest demand – although the graph also assumes the availability of interconnection capacity for export. For solar power, the average demand comparison is more suitable since highest solar outputs occur in the daytime, i.e. at times of relatively high power demand.*

By 2020, many states face significant challenges in managing variability in the electricity system

A. MANAGING WIND POWER

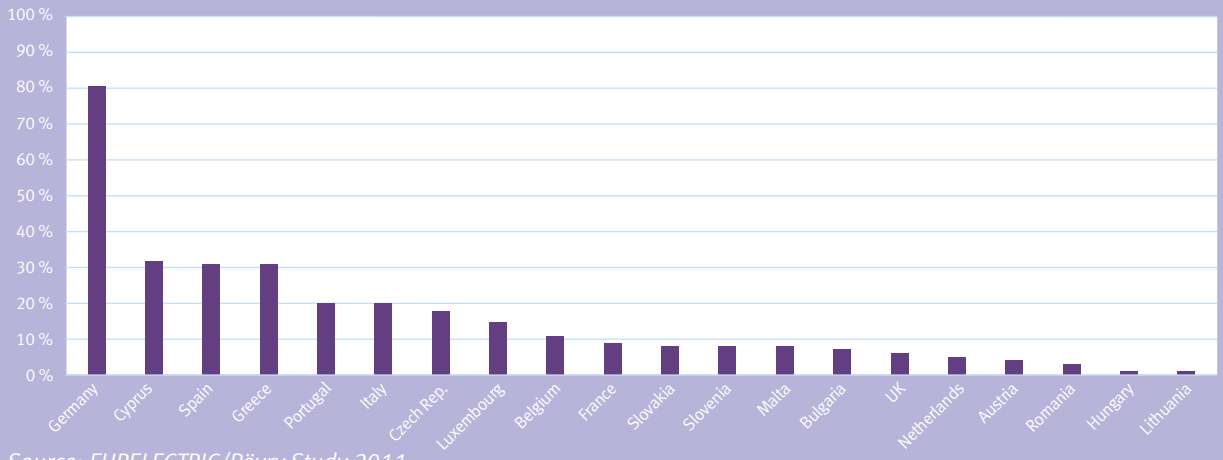
Figure 3: Total wind capacity according to NREAPs, as a percentage of minimum demand & interconnectivity in summer 2020[6]



Source: EURELECTRIC/Pöyry Study 2011

B. MANAGING SOLAR POWER

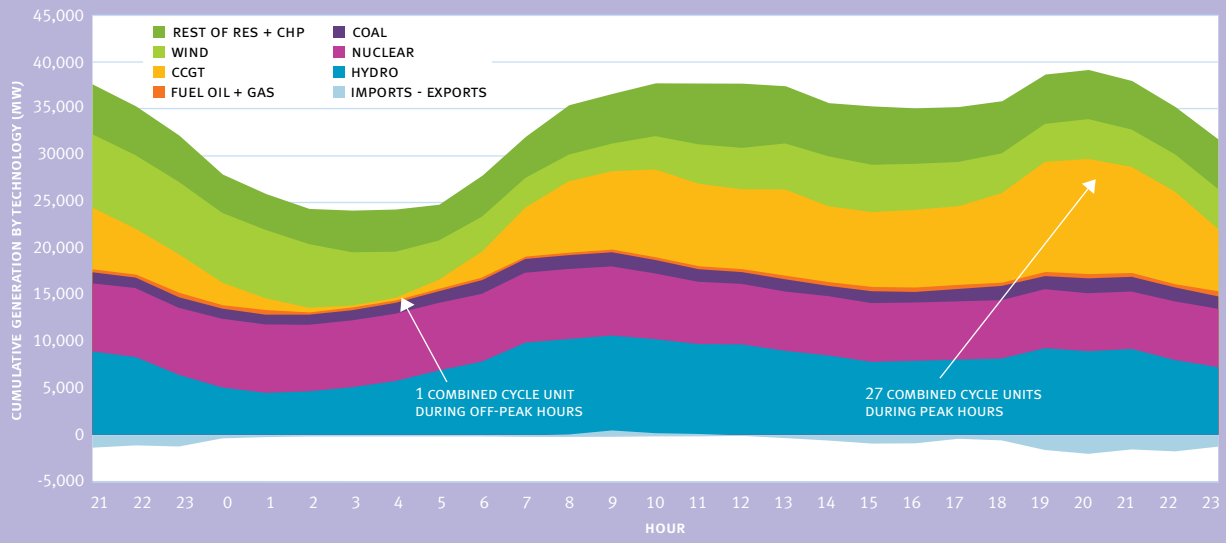
Figure 4: Total solar capacity according to NREAPs, as a percentage of average demand



Source: EURELECTRIC/Pöyry Study 2011

[6] *The minimum average summer demand is an average of lowest overnight load in 2020 according to a calculation by Pöyry Energy Consulting. The interconnector capacity calculation assumes all capacity is available for export, including foreseen additions to interconnector capacity up to 2020.*

Figure 5: Example of flexible back-up capacity needed within the Spanish system – 3 March 2010



Source: Data from Red Eléctrica de España (REE), figure elaborated by Endesa

SOURCES OF FLEXIBILITY - A SYSTEM APPROACH

GENERATION
Flexible and back-up capacity

MARKET DESIGN
Increased market integration
Improved day-ahead, intraday and balancing markets

DEMAND SIDE
Smart grids and flexible loads

NETWORKS
Increased transmission capacity
Reinforced and upgraded distribution capacity

The challenge of managing variability will require innovation and investments as well as a reliable regulatory framework that provides the right incentives for energy infrastructure investments in this new environment. Variability requires back-up capacity from dispatchable generation (thermal and hydro) and an extended transmission and distribution grid. Improved forecasting of wind and solar power, enhanced ability to regulate dispatch from the existing generation fleet, and improved balancing, also on the border, intra-day and day-ahead markets will also be key elements. With market-coupling within Central Western Europe (CWE) and between CWE and Northern Europe a big step towards the 2014 target models has recently been made.

Equally, a reinforced and upgraded European distribution grid is needed, able to absorb the majority of variable RES capacities. Demand side measures, smart grids and new interconnections will complete the effort to balance the electricity system. Research, development and deployment (RD&D) can speed up this development. Technological development both of RES generation as well as of transmission and distribution systems is necessary to reach the targets. Such development requires involvement from equipment manufacturers, the electricity industry and research institutions. This requires large, targeted and coordinated R&D support, combined with support for demonstration projects and stable market conditions in order to ensure the implementation of increasingly competitive RES technologies.

A EUROPEAN APPROACH TO POLICY AND MARKETS WILL ENSURE THAT RENEWABLES ENABLE SUSTAINABILITY, SECURITY OF SUPPLY AND COMPETITIVENESS

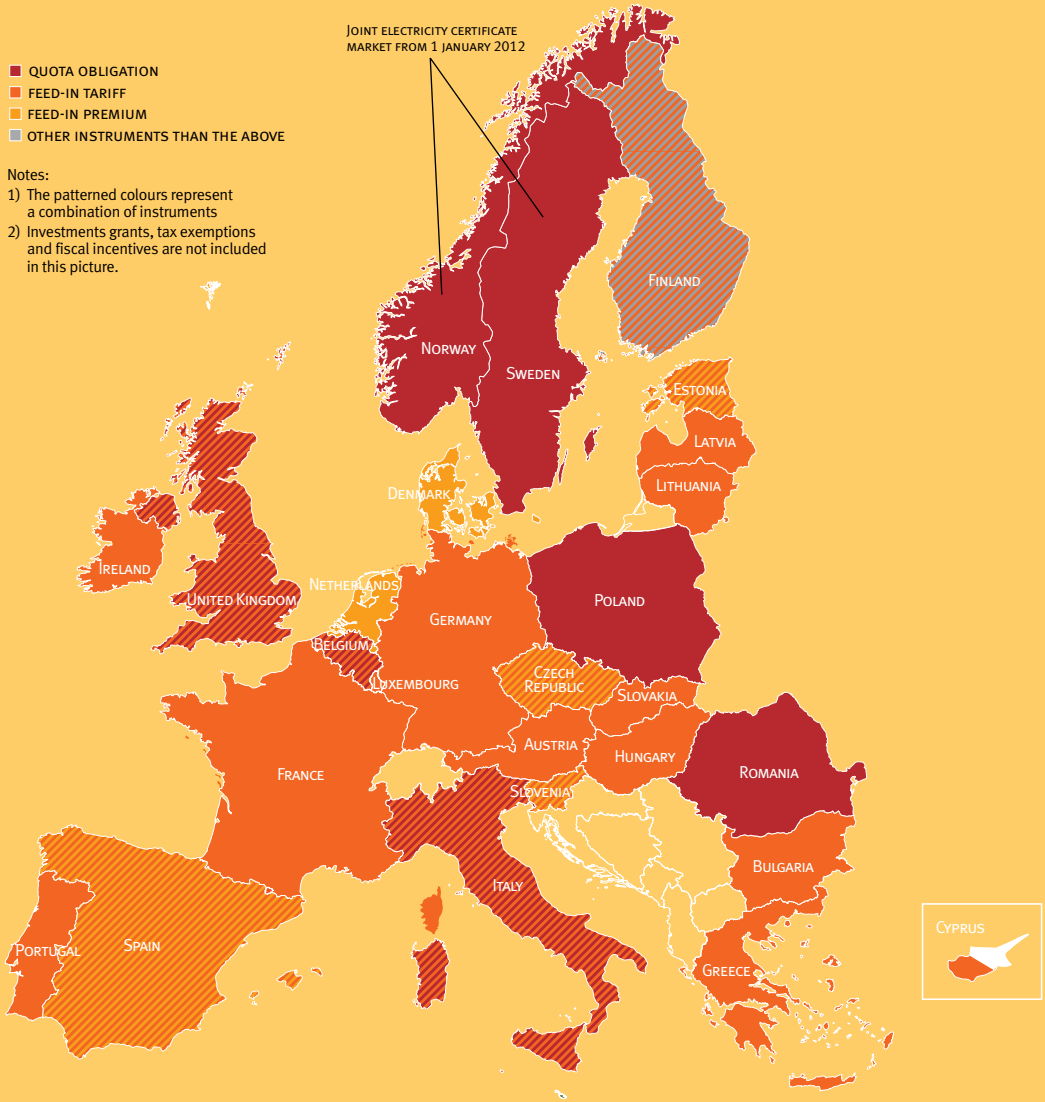
The increased need for back-up and balancing capacity has also raised the issue of electricity market design. In a more flexible energy system, some fossil plant will operate only for relatively short periods when renewable output is not available. Such plant is only able to cover its costs if prices at such times are extremely high, but this may not be politically acceptable. Are capacity remuneration mechanisms (CRM) the solution to this problem?

To enhance electricity markets' ability to deliver generation adequacy, governments and regulators must first of all allow energy-only markets to function properly. To this end, distortions which hinder the balance of demand and supply must be removed. Such distortions include regulated end-user prices, restrictions on plant operations, wholesale price caps, and other regulatory or administrative measures which unnecessarily hinder wholesale market outcomes. At the same time, integration of wholesale markets must remain a top priority for EU and national policymakers.

For EURELECTRIC members, the two most important actions to take are to establish functioning and integrated wholesale markets and to incentivise RES generators to progressively enter the wholesale market. In markets where the above improvements have been made and generation adequacy is nevertheless endangered (through reduced investments and early decommissioning), policymakers should consider introducing a CRM. If introduced, such mechanisms should be able to be phased out – without jeopardising investment security – once the market itself can deliver the appropriate investment incentives to ensure system adequacy. The need to introduce a CRM should ideally be assessed at a regional level or at least in coordination with neighbouring markets. In any case, the design should ensure consistency with the process of EU market integration and not distort the functioning of the market (i.e. provide the correct price signals).

EU member states have developed different support schemes for RES, like feed-in tariffs or certificate schemes (Figure 6). A European approach to market design is needed to ensure a European level playing field and to avoid negative consequences of the fragmented picture that exists for RES subsidies – more than 30 across the EU. ACER and the European Commission – in cooperation with all relevant EU and national stakeholders – should promote increased use of flexibility mechanisms with a view to more convergence.

Figure 6: Current support schemes in place in EU member states



Source: Ecofys et al, Financing Renewables in the European Energy Market, 2011

In addition, the NREAPs, submitted at the end of 2010 to the European Commission, are nationally focused and do not consider an EU-wide context. We believe there is a need for more convergence on RES support schemes across national boundaries. The joint certificate market between Sweden and Norway from 2012 can be considered by other members as a promising benchmark on the path towards convergence.

Making use of the cooperation mechanisms set by the RES directive is another important element to enhance cooperation as well as efficient development of RES in Europe.

The electricity industry is committed to competitive electricity prices, security of supply, system stability and carbon-neutrality. Studies like EURELECTRIC/Poyry 2009 or Primes 2008 reveal that a European and market-based approach will reduce the costs to deliver on these goals significantly. A European approach to renewables can exploit open markets and geographic advantages to deliver the necessary growth. A European approach would also provide consistency with overall European market integration, with the EU energy market to be set up, according to the European Council, by the end of 2014.

Regional integration is a promising means to achieve the target. The best performing region could serve as a benchmark for the others.

20% RES BY 2020: HOW TO GET THERE? EURELECTRIC RES ACTION PLAN RECOMMENDATIONS AT A GLANCE

The following table summarises, at a glance, EURELECTRIC's findings and key recommendations on the RESAP task forces. The full reports of the task forces can be found on the dedicated website.

RESAP

PLANNING OF FUTURE GRID INFRASTRUCTURE

FINDINGS

- Grid investments are the key enabler to allow markets to cope with large volumes of variable RES. The introduction of high levels of RES will not only considerably affect both distribution and national transmission networks, but also transmission networks in adjacent and further away countries.
- European grid planning and integrated markets are urgently needed to meet the 2020 renewable energy targets.
- In particular, urgent and extensive grid investments are needed to increase interconnection capacities, remove internal bottlenecks and develop offshore grids.
- While smart grids will benefit all parts of the electricity value chain, DSOs will bear the lion's share of the initial investments to encourage development of commercial solutions for smart grids.

RECOMMENDATIONS

- In order to achieve the 2020 RES targets significant grid investments are needed now.
- The focus on investments should be shifted from a national to a regional and pan-European perspective.
- Given that benefits of regional grids (including off-shore grids) are shared among customers from different member states, the European Commission and ACER should develop cost-sharing principles to allow multi-national funding of transmission lines.
- The regulatory framework must provide the right incentives for energy infrastructure investments in this new environment.
- Apart from a strong political commitment to establish the right regulatory conditions, movement towards intelligent power systems will require increased cooperation among all players in this area, including customers.
- The 10 Year Network Development Plan (TYNDP) is a key tool for a European approach to grid planning: it should not be a compilation of national plans but a pan-European vision for planning grid infrastructure in line with long-term EU policy targets.
- The TYNDP should be updated as soon as possible to reflect the National Renewable Energy Action Plans (NREAPs) and include a list of priority projects.

Regulation for smart grids

Findings	Recommendations
• Suboptimal rates of return and regulatory instability are hampering investment in smarter distribution grids. • The roll-out of smart meters is being delayed by a lack of clarity regarding the roles and responsibilities of regulated and market operators. • Regulators are taking a narrow view when evaluating cost-efficiency, penalising extra expenditure on R&D or smart grid pilot projects and encouraging business-as-usual expenditure instead.	• Traditional methods of regulation do not provide the right incentives for investments in innovation. • Regulators should reward network companies for cost-efficient grid and RD&D investments. This will imply, in many member states, revising the outdated regulatory models to which system operators are currently subject. • Regulators should provide network operators with a reasonable rate of return for cost-efficient grid investments. • DSOs should be responsible for the roll-out of smart meters. It has to be defined how the costs of this roll-out should be recovered.

Role of smart grids and flexible loads

Findings	Recommendations
• The new energy paradigm, based on a large-scale integration of variable and distributed RES, and characterised by the emergence of new loads, calls for increased flexibility within all segments of the electricity value chain, in particular at its lower end. Business as usual will not deliver. • A large share of variable RES cannot be integrated if distribution system operators do not have information on what goes on between the substation and the meter. Smart grids are needed. • Customers cannot be expected to participate in retail markets if price signals remain blurred. • A new set of agreements will have to be established between suppliers and DSOs. Such agreements can be set out in grid codes and ancillary services.	• Design regulatory incentives that encourage DSOs to invest in a smarter distribution grid, including innovative and ICT-based investments. • Develop a clear market model for smart grids and demand-side participation that clarifies the roles and responsibilities as well as the interactions between suppliers and DSOs. • Remove regulated prices for customers (or make them market-reflective), allowing retail markets to deliver attractive products and services based on correct price signals.

Requirements for flexible and back-up capacity

Findings

- Power ramps, i.e. sudden requests for massive amounts of active power, will introduce a step change into the EU electrical systems, influencing the way they are operated.
- Each power generating technology has its own degree of technical flexibility, influenced by several parameters such as its design.
- Technical flexibility alone does not allow us to judge whether a specific technology will come into the play and have a role. That depends to a large extent on the associated costs and market design (e.g. nuclear).
- Hydropower plants are the most responsive to variations in load and power ramps, followed by CCGTs. Nuclear actually scores higher if load gradients are taken as the sole parameter.
- Fossil-fuelled power plants operating in load-following mode have a lower efficiency, hence higher emissions than baseload plant.

Recommendations

- A system approach is needed which takes into account (1) flexibility on the generation side; (2) flexibility on the demand side; (3) the degree of market integration; (4) the degree of interconnection of different power systems.
- A mechanism to pay the RES requirements for flexible and back-up capacity must be defined.
- A basket of different solutions will have to be implemented, taking into account the specifities of different countries and/or regions.
- Investment should be urgently directed towards RD&D programmes which aim at enhancing the flexibility of dispatchable power plants.
- If gas is to play a major role in terms of flexibility, the underlying gas markets need to develop towards a single EU gas market which flexibly delivers gas supplies to power stations (both commercial and technical flexibility).

Biomass market development to 2020

Findings

- Biomass is a key renewable resource and will form a major part of reaching the 2020 target; unlike most other renewables it is a dispatchable form of power generation.
- Use of primary biomass will increase by a multiple of 2.5 to reach the 2020 targets.
- Significant investment is needed in biomass supply chains within the EU.
- In order to reach the 2020 targets, we estimate that about one third of total biomass will need to be imported from outside the EU; for the power & heat sector we estimate about one fifth will need to be imported.

Recommendations

- Mandatory EU-wide sustainability criteria for biomass should be introduced.
- Stable, consistent and sufficiently attractive incentives for production of electricity and heat from biomass are needed.
- Maximum use should be made of co-operation mechanisms, in order to ensure that bioenergy is produced as close as possible to the source of the biomass resource.
- A framework is needed to ensure that biomass producers enhance supply to the market and ensure that supply is continuous.
- Markets for primary biomass resources should be open and there should be no restrictions to limit supply to favoured industries.

Hydro and pump storage

Findings

- Hydropower, representing 17% of the European electricity output, also plays a prime role in backing up more variable renewable energy sources such as wind and solar.
- Hydropower is the backbone of an integrated renewable system, a renewable backing other renewables.
- Hydropower is by far the most important renewable energy source in Europe today and there is still an important hydro potential to be developed in Europe. Nevertheless, the share of hydropower compared to other renewables will be reduced in the future.
- However there will be an important increase of capacity because of upgrading existing storage power plants to new pump storage power plants but also because of building new pump storage power plants with at least one new reservoir. Because of its flexibility und storage function the role of hydropower in the generation portfolio will increase.
- Hydropower plants (run-of-river power plants and all kinds of storage power plants) are the best solution to provide ancillary services and reserve capacity.

Recommendations

- Remove obstacles to hydropower development in Europe and address conflicting policy objectives in a transparent way.
- Make the hydro and pumped storage potential available on a European scale via grid development.

Impact on wholesale electricity markets

Findings

- Short-term wholesale price volatility will increase as a result of increasing variable RES generation.
- Negative prices prove that there is a lack of grid capacity to transport low marginal cost renewable energy to places where it is less efficient (or less profitable due to support schemes) to build similar RES.
- Lower load factors for conventional generators will lower profitability and create uncertainty for future investments in flexible and back-up generation plants.

Recommendations

- Increase transmission capacity (especially cross-border) to ensure integration and harmonisation in Europe.
- Integrate day-ahead, intraday and balancing markets.
- Ensure a level playing field in balancing responsibility for all producers to incentivise market participants to improve scheduling and forecasting and thus limit system costs.
- Let the markets find their demand-supply equilibrium by removing price caps.
- Incentivise demand response and storage technologies.

Possible review of market design

Findings

- EU electricity markets are experiencing fundamental changes to meet the 2020 RES targets. Larger shares of RES electricity reduce operating hours and profitability of flexible and back-up plants.
- These conventional plants are necessary to cope with RES intermittency and unpredictability. In some EU markets, lower levels of expected profitability are significant, raising concerns about future investment decisions and thus generation adequacy.
- Energy-only markets would function perfectly if prices were free to rise well above marginal costs during carcity hours, up to a level set only by consumers' willingness to pay that price.
- However, in current electricity markets "scarcity prices" are reached only at some limited moments: revenues generated by price spikes are generally not enough to cover fixed costs of "peaking" plants.
- If this situation persists, the necessary flexible and back-up generation capacity could eventually be shut down and not replaced by new investments. To avoid this, the functioning of today's electricity markets must be closely monitored and eventually their design might have to be improved.

Recommendations

- Energy-only markets must be allowed to function properly by removing regulatory distortions, e.g. price caps, which hinder the balance of demand and supply.
- The target models for day-ahead, intraday and forward markets should be implemented to achieve an EU integrated market by 2014.
- RES generators must be incentivised to enter into the market on a level playing field with all other generators.
- Market-based demand needs to be able to participate in spot price formation.
- In countries where generation adequacy is endangered, despite efforts to put in place all the above recommendations, policymakers should consider introducing a capacity emuneration mechanism (CRM).
- CRMs should be designed in coordination with neighbouring markets and be phased out once the market can deliver the adequate investment incentives.
- ACER and the European Commission should develop a set of minimum EU harmonisation requirements for CRMs. This will ensure the well-functioning of regional markets and consistency with the goal of completing the internal electricity market by 2014.

Cross-border intra-day and balancing markets

Findings

- Market integration tools such as market coupling, cross-border intraday and cross-border balancing are indispensable in ensuring and facilitating the contribution (on a competitive basis) of all available flexible generation and demand sources.
- In particular, market timeframes closer to real time (intraday and balancing) will become increasingly important to adjust demand and supply with increasing shares of variable and unpredictable RES generation.

Recommendations

- Cross-border intraday and balancing markets need to be urgently implemented on a harmonised basis throughout Europe following the target models agreed by policymakers and stakeholders.
- Continuous (implicit) intraday trade with a single shared order book allowing also over-the-counter access for the whole of Europe will facilitate coordination of all flexible sources, allowing upwards and downwards scheduling variations up to one hour before delivery.
- Integrated balancing systems (TSO-TSO with common merit order) will fine-tune demand and supply in the last hour before real time in the most efficient way.

Analysis of National Renewable Action Plans (NREAPs) and investment climate for RES

FINDINGS	RECOMMENDATIONS
• The NREAPs do not indicate a move towards developing renewables on an EU-wide scale; many opportunities for co-ordination between countries are not taken up. • RES growth rates in the plans are very ambitious and for many technologies exceed previous growth rates, especially for offshore wind and solar. • The amount of variable generation in proportion to demand is likely to create significant challenges for system stability in some countries. • The support schemes referred to in the national plans are in general insufficient to reach the targets. • The national plans show a relatively high reliance on RES electricity compared to some modelled studies.	• The European Commission should take action against member states who have submitted plans which are unrealistic (in terms of technology growth, support, etc.). • The progress reports submitted by member states on a biannual basis should be clear on where the member state is deviating from its national action plan and what measures it is taking to get back onto its interim target trajectory. The European Commission should closely analyse these reports and take action against member states deviating from their trajectory. • Stable and predictable support schemes are needed.

Harnessing EU synergies: co-operation mechanisms (within the analysis of the NREAPs report)

FINDINGS	RECOMMENDATIONS
• The lack of the use of co-operation mechanisms threatens the feasibility of reaching the targets, as well as greatly increasing the costs.	• The European Commission should establish a framework for the utilisation of co-operation mechanisms.

How best to foster research, development and deployment (RD&D) of RES technologies

Findings

- All technologies pass through the same stages of the innovation cycle: from basic research through development, demonstration, deployment, and commercial market uptake. Although this may sound like a linear process, in reality the innovation cycle is often an iterative process.
- The successful commercialisation of RES technology requires support on all levels.
- RES technologies are very differently developed nd deployed in EU countries, based not only on geographical and climate differences but also on political preferences

Recommendations

- Adopt a system approach, not a RES-only approach. The whole electricity value-chain should be better represented.
- Upgrade significantly EU energy-related RD&D spending, in order to get from promise to practice.
- Better co-ordinate national and EU-level RD&D projects.
- In order to deliver on the 2020 target focus on those technologies which are the most advanced and the most promising, based on cost-benefit analysis.
- Progressively shift from production subsidies to RD&D funding for new innovative RES technologies.
- Lighten the bureaucratic process around EU research programmes and focus on results. Question principles such as geographical coverage, which might be useful in one case, but not in all.
- Use benchmarking and knowledge transfer on an EU level, since RES technologies are very differently developed from one site/country to the other.
- Set up incentives for utilities as well as suppliers, via a consistent framework, to engage more in RD&D.
- Set up innovation and demonstration hubs within the EU.

Life cycle analysis of RES technologies

Findings

- Lifecycle emissions of GHG from RES are, in general, considerably lower than those associated with fossil fuels. Nuclear is in the same range and performs better than biomass.
- For other impact categories (air pollution, water use, biodiversity) reliable global indicators are lacking and local evaluation is paramount: identical plants will have different impacts according to their location.
- An increasing share of RES affects the operation of flexible generation technologies – which is not accounted for today.
- Similarly, grid and market issues in particular in the EU context are also poorly taken into consideration.

Recommendations

- The assessment of emissions related to RES has to include the impact on back-up operation and thus the increased emissions due to flexible power plants.

Notes

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The **Union of the Electricity Industry – EURELECTRIC** is the sector association representing the common interests of the electricity industry at pan-European level, plus its affiliates and associates on several other continents.

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