

Promotion of renewable energy sources in the European electricity production during the years 2005 to 2015 with special regards to Austria, Germany, Czech Republic and Slovakia

Gerhard Karlicek, TU Wien

Viktória Soročinová, VSE Praha

Co-operating universities



Financial support by



Prague and Vienna, 2016

Table of contents

Introduction and work structure.....	4
Methodology, data and first sources for targets on a European level	4
Targets.....	5
Directive 2001/77/EC	5
COM (2004) 366	6
Directive 2009/28/EC	6
Promotion strategies.....	6
Guarantees of origin.....	8
Austria	9
Legal situation	9
Green Electricity Act 2002 (Ökostromgesetz)	9
Amendments of the Green Electricity Act (Ökostrom-Gesetzesnovelle).....	9
Current Green Electricity Act of 2012 (Ökostromgesetz).....	10
Summary of the Austrian support scheme.....	10
Renewable electricity production	11
Cost.....	12
Germany.....	14
Promotion.....	14
Development.....	15
Controversy concerning the EEG.....	16
Cost of the EEG.....	17
Czech Republic.....	18
Cost.....	18
Promotion.....	18
Targets.....	19
Excursus: Promotion of PV in the Czech Republic.....	21
Slovakia.....	23
Cost.....	23
Promotion.....	23
Targets.....	24
Comparison of wholesale prices	26
Conclusions.....	27
Table index	29

Figure index 29

Introduction and work structure

This seminar paper analyzes the history of the promotion of renewable energy sources in the European electricity generation. The focus will be on the years 2005 to 2015. It will be analyzed

- which targets were set for the total electricity production from renewable energy sources in the European Union,
- how these targets were distributed among the member states,
- which promotion strategies were used to achieve these targets,
- what the costs were for potential subsidies or promotion schemes,
- what technologies were implemented in the various countries - be it hydro power, photovoltaics, wind power or biomass,
- and whether the targets for renewable energy production have been met or not.

Concerning the member states this seminar paper will focus on Austria, Germany, the Czech Republic and Slovakia.

Methodology, data and first sources for targets on a European level

The methodology consists of literature research and comparison of set targets and actual production. Important documents on a European level are (in chronological order):

- COM(96)576, Communication from the Commission. Energy for the future: Renewable sources of energy. Green Paper for a Community Strategy. Brussels, 20.11.1996.
- COM(97)599, Communication from the Commission. Energy for the future: Renewable sources of energy. White Paper for a Community Strategy and Action Plan. Brussels, 26.11.1997.
- **Directive 2001/77/EC of the European Parliament and of the Council of September 2001 on the promotion of electricity produced from renewable energy sources in the internal electricity market.**
- COM(2006)105, Green Paper: A European Strategy for Sustainable, Competitive and Secure Energy. Brussels, 8.3.2006.
- COM(2006)848, Communication from the Commission to the Council and the European Parliament. Renewable Energy Road Map. Renewable energies in the 21st century: Building a more sustainable future. Brussels, 10.1.2007
- COM(2007)1, Communication from the Commission to the European Council and the European Parliament. An Energy Policy for Europe. Brussels, 10.1.2007.
- COM(2008)30, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. 20 20 by 2020, Europe's climate change opportunity. Brussels, 23.1.2008.
- **Directive 2009/28/EC of the European parliament and of the council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC.**

The Green Paper of 1996 aims at a *“clear ambitious, and yet realistic, increase in the contributions of renewables to the Community energy balance”* from 6% in 1996 to 12% in 2010 and marks the first step to a defined goal for the use of renewable energy sources. In the following year, the White Paper of 1997 confirms this goal by stating: *“The overwhelmingly positive response received during the*

consultation process has confirmed the Commission's view that an indicative target is a good policy tool, giving a clear political signal and impetus to action. The strategy and action plan in this White Paper therefore are directed towards the goal of achieving a 12% penetration of renewables in the Union by 2010 - an ambitious but realistic objective."

Targets

Directive 2001/77/EC

In October 2001 the Directive 2001/77/EC took effect. It states in Article 1: *"The purpose of this Directive is to promote an increase in the contribution of renewable energy sources to electricity production in the internal market for electricity and to create a basis for a future Community framework thereof."*

This directive confirms the target of 12% for gross renewable energy consumption and sets the indicative share of electricity produced from renewable energy sources in total Community electricity consumption by 2010 to 22,1%. The difference between energy and electricity is important in this context and has to be distinguished. This directive also requests the member states to set national indicative targets for future consumption of electricity produced from renewable energy sources.

This directive was amended by the "Act of Accession of the Czech Republic, Estonia, Cyprus, Latvia, Lithuania, Hungary, Malta, Poland, Slovenia and Slovakia" in 2004 that adds the national indicative targets for these countries. In 2006 Bulgaria and Romania were added by the Directive 2006/108/EC. The addition of these countries also changed to overall target for 2010 to 21% RES-E production. The target for the EU15 remained at 22%.

The following table lists the national indicative targets for the member states covered in this research paper:

Table 1: National indicative targets for Austria, Czech Republic, Germany and Slovakia.

	RES-E TWh 1997	RES-E % 1997	RES-E % 2010
Austria	39,05	70	78,1
Czech Republic	2,36	3,8	8
Germany	24,91	4,5	12,5
Slovakia	5,09	17,9	31

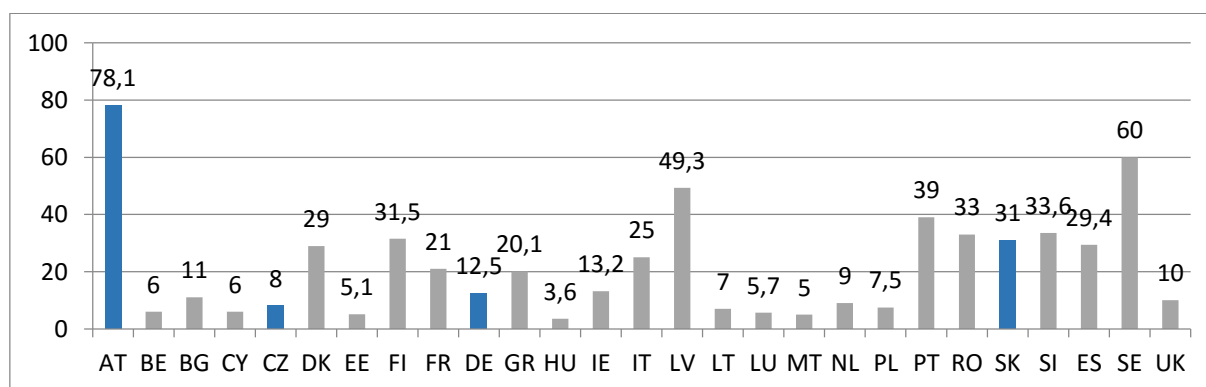


Figure 1: National indicative targets for all EU member states. RES-E % in 2010.

COM (2004) 366

The first evaluation of Directive 2001/77/EC for the EU15 was published in 2004 by the European Commission in “COM (2004) 366”, the “Commission Report in accordance with Article 3 of Directive 2001/77/EC, evaluation of the effect of legislative instruments and other Community policies on the development of the contribution of renewable energy sources in the EU and proposals for concrete actions”. The new member states underwent an initial evaluation only in 2006.

Directive 2009/28/EC

This directive, which amends and appeals earlier Directives 2001/77/EC and 2003/30/EC, creates a common framework for the use of renewable energy in the EU so as to limit greenhouse gas (GHG) emissions and promote cleaner transport. To do so, it sets targets for all EU countries with the overall aim of making renewable energy sources account for 20 % of EU energy and 10 % of energy specifically in the transport sector by 2020. ¹

In order to achieve the target of 20% total renewable energy consumption, each member state created a national action plan with individual targets for renewable energy use in the sectors of electricity production, heating & cooling and transport.

Table 2: Renewable energy targets for 2020.

	Share of energy from renewable sources in gross final consumption of energy, 2005 (S ₂₀₀₅)	Target for share of energy from renewable sources in gross final consumption of energy, 2020 (S ₂₀₂₀)
Czech Republic	6,1 %	13 %
Germany	5,8 %	18 %
Austria	23,3 %	34 %
Slovak Republic	6,7 %	14 %

Table 3: RES-E targets according to the National Renewable Energy Action Plans.

	RES-E in 2005	RES-E target in 2020
Austria	60,8	70,6
Czech Republic	4,5	14,3
Germany	10,2	38,6
Slovak Republic	16,7	24

Promotion strategies

There is a range of promotion strategies to support electricity from renewable energy sources. According to eur-lex.europa.eu² the existing support schemes cover the following:

¹ Source: <http://eur-lex.europa.eu/summary/EN/uriserv:en0009>

² <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv%3AI24452>

- **Feed-in tariffs** exist in most of the Member States. These systems are characterised by a specific price set for a specific period of time, that must be paid by electricity companies, usually distributors, to domestic producers of green electricity.
- **Green certificate system**, currently in force in Sweden, the United Kingdom, Italy, Belgium and Poland. RES-E is sold at the conventional market price. In order to finance the additional cost of producing green electricity, and to ensure that it is generated in sufficient quantities, all consumers are obliged to purchase a certain number of green certificates from RES-E producers according to a fixed percentage (quota) of their total electricity consumption/generation.
- **Tendering systems** exist in two Member States: Ireland and France. Under this procedure, the State issues a series of invitations to tender for the supply of RES-E, which will be sold at market price. The additional cost is passed on to the final consumer in the form of a special tax.
- **Tax incentives** are used exclusively in Malta and Finland.

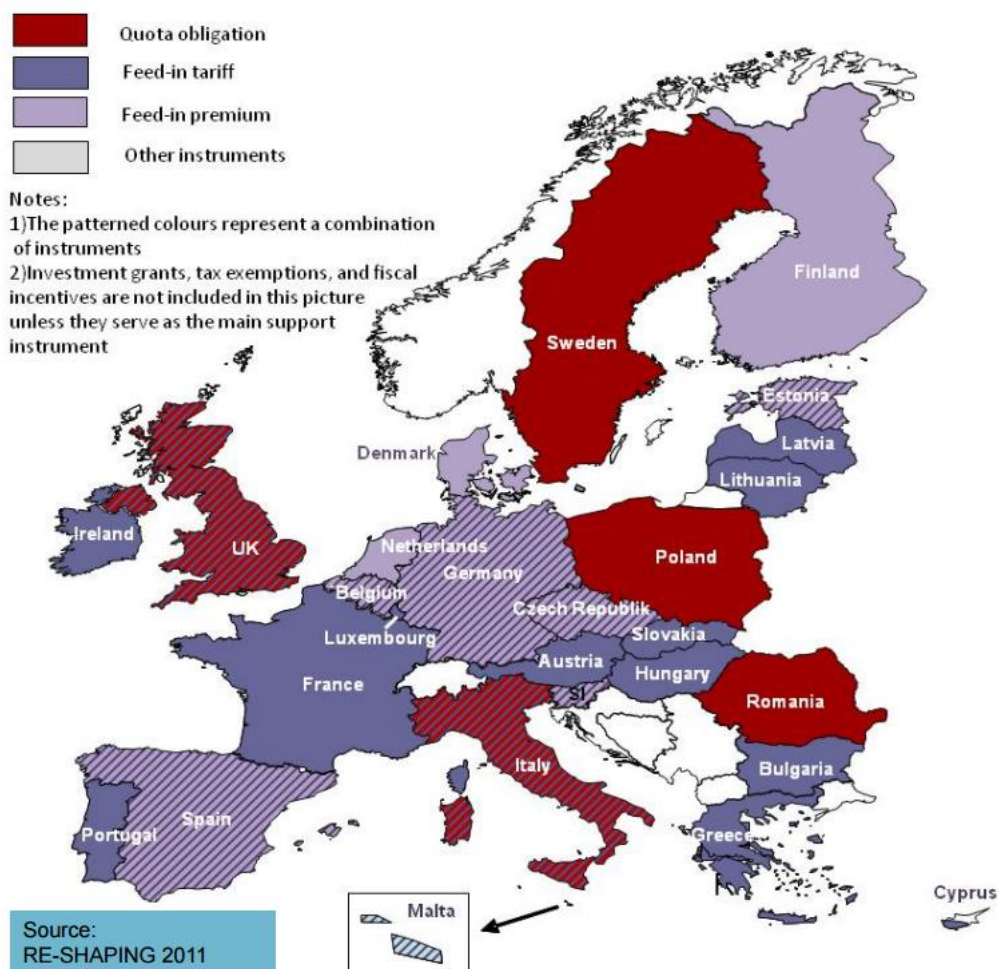


Figure 2: Main promotion strategies of the EU countries (source: RE-SHAPING, 2011)

The different forms of renewable energy affected by this support include (eur-lex.europa.eu³):

- **Wind energy**, for which analyses show that support is too low for any take-off in a quarter of the Member States. Another quarter of Member States provide enough support but still obtain

³ <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv%3A124452>

mediocre results. Feed-in tariffs are currently the most effective systems for wind energy in Germany, Denmark and Spain.

- ***Biomass** forestry requires the use of straw, which is taken into account in analyses of biomass forestry. Denmark is the main country using this type of biomass. In close to half of all European countries, support for this form of renewable energy is still insufficient to develop this high potential sector.*
- ***Biogas** sector is closely linked to environmental policy for waste treatment. In nearly 70% of cases not enough support is provided for the development of this technology.*
- *The other renewable energy sources to benefit from this support are **hydroelectricity** and **photovoltaic solar energy**. There are several other sources of renewable energy (**geothermal, wave, tidal, solar thermal**, etc.) which, although they receive support in some Member States, have not yet been developed on an industrial scale.*

Guarantees of origin

Guarantees of origin (or “green certificates”) are an important element in the support of renewable energy. They enable producers to prove the origin of their produced (electrical) energy. Every country has to have a database for these certificates. These are called Stromnachweisdatenbank in Austria and Herkunftsnachweisregister in Germany. The standard size of a certificate for electricity is 1MWh.

“For the purposes of proving to final customers the share or quantity of energy from renewable sources in an energy supplier’s energy mix in accordance with Article 3(6) of Directive 2003/54/EC, Member States shall ensure that the origin of electricity produced from renewable energy sources can be guaranteed as such within the meaning of this Directive, in accordance with objective, transparent and non-discriminatory criteria.”⁴

A guarantee of origin shall specify at least:

- a) the energy source from which the energy was produced and the start and end dates of production;*
- b) whether it relates to (i) electricity; or (ii) heating or cooling;*
- c) the identity, location, type and capacity of the installation where the energy was produced;*
- d) whether and to what extent the installation has benefited from investment support, whether and to what extent the unit of energy has benefited in any other way from a national support scheme, and the type of support scheme;*
- e) the date on which the installation became operational; and*
- f) the date and country of issue and a unique identification number. (Article 15, Directive 2009/28/EC)*

Electricity from renewable sources can only be sold as such, if the guarantee of origin is transferred to the consumer. It is then devaluated and can’t be used anymore.

⁴ Article 15, Directive 2009/28/EC

Austria

Legal situation

Green Electricity Act 2002 (Ökostromgesetz)

The Directive 2001/77/EC is implemented in the Austrian legislation by the “Green Electricity Act” (*“Ökostromgesetz sowie Änderung des Elektrizitätswirtschafts- und -organisationsgesetzes (ElWOG) und das Energieförderungsgesetzes 1979 (EnFG)”*, short: *“Ökostromgesetz”*) of 2002, that came into force in 2003. It is the first nationwide legislation to regulate acceptance of delivery of RES-E. Before 2003 this was governed by the several federal states. The targets of this law are

1. to reach a share of renewable energy sources for electricity production of 78,1% as agreed upon in Directive 2001/77/EC;
2. to use the means for promotion of renewable energy sources in an efficient way;
3. to set the political focus on achieving market maturity of new technologies;
4. to support cogeneration plants and promote their modernization;
5. to increase the electricity production from water power plants with a maximum capacity of 10MW, that have a purchase and compensation commitment, to 9% by 2008;
6. to guarantee investment security for existing and new plants;
7. to balance the burden of promotion of electricity production from renewable sources and cogeneration plants;
8. to promote electrical energy generation from renewable energy sources with special regards to Directive 96/92/EC and Directive 2001/77/EC.

The targets also state that to reach the share of RES-E of 78,1% by 2010 the share of RES-E excluding hydro power feed into the public grid has to be at least 4% by 2008.

This law implements an obligation to accept delivery of electricity from renewable sources at fixed feed-in tariffs. These tariffs are set in the “Green Electricity Feed-In Tariff Act” (*“Ökostrom-Einspeisepreisverordnung”*). These feed-in tariffs are guaranteed for 13 years starting from commissioning.

Amendments of the Green Electricity Act (Ökostrom-Gesetzesnovelle)

The Green Electricity Act was amended in 2006, 2007, 2008 and 2009.

The Green Electricity Act of 2002 induced a boom of investments in renewable energy plants. The amendment of 2006 reduced feed-in tariffs and their period of validity. This environment has led to a halt in the construction of new plants. The increase of produced renewable energy is caused by renewable power plants that were approved in the years before 2006. The amendment of 2009 and the related Feed-In Tariff Act of 2010 created an attractive environment for investments again.^{5 6}

Since 2006, the OeMAG (Abwicklungsstelle für Ökostrom AG) - a processing and administration centre - processes support for the specific technologies. The amendment of 2006 also set the goal of increasing the share of RES-E excluding hydro power to 10% by 2010.

⁵ Source: <http://www.umweltbundesamt.at/umweltsituation/energie/erneuerbare/oekostrom/>

⁶ Source: https://www.igwindkraft.at/?mdoc_id=1014570

The amendment of 2009 sets a goal of 15% RES-E (including new small and medium hydro power plants) for 2015. Due to the changed conditions (includes hydro power plants) it cannot be directly compared to the goal of 10% by 2010, but it seems to be less ambitious. ⁷

Current Green Electricity Act of 2012 (Ökostromgesetz)

The Green Electricity Act of 2012 came into effect on July 1st 2012. It implements Directive 2009/28/EC ("Renewables Directive") in the Austrian law. This act introduces several changes to the general conditions for renewable energy. Supported RES-E delivered to customers should account for 15% of the total electricity demand by 2015 and the total amount of support for new plants is limited with 50 million Euros per year, with a decrease of 1 million per year for the next 10 years.

The fundings for renewable energy are raised with the "green electricity support share" (Ökostromförderbeitrag) and the "fixed green electricity fee" (Ökostrompauschale). The green electricity support share is a premium on top of the "grid usage and loss fee" (Netznutzungs- und Netzverlustentgelt). It is proportional to the electricity usage and is set each year by decree. The fixed green electricity fee is a fixed amount for each meter point in the grid. ⁸

Summary of the Austrian support scheme

The promotion of green electricity is backed by the green electricity support share, the fixed green electricity fee and revenues from guarantees of origin.

Operators of renewable power plants sell their produced electricity to the OeMAG, the processing and administration center for renewable energy, and get the feed-in tariffs for their energy. The grid operator has to physically distribute this electrical energy in its grid.

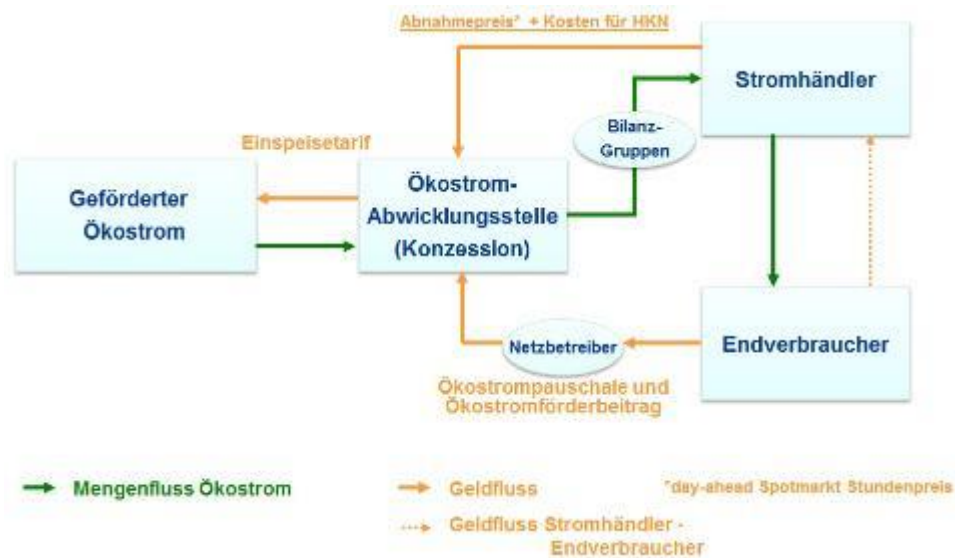
The green energy is distributed by the OeMAG to the electricity suppliers in relation to their market share. For example, a supplier with 5% market share gets 5% of the green energy assigned. They have to pay to current market price (day ahead spot market hourly price) and the fee for the guarantees of origin.

The green electricity support share (relative to the usage) and the fixed green electricity fee (33 Euros per household per year) is paid by the consumer to the grid operator, which delivers the sum to the OeMAG to back the promotions.

The tariffs for the Austrian support scheme are either evaluated every year by three federal ministries or decreased automatically by 1%.

⁷ Source: https://www.igwindkraft.at/?mdoc_id=1008838

⁸ Source: <http://oesterreichsenergie.at/energiepolitik/einfuehrunggrundlagen-erzeugung/oekostromfoerderung.html>

Figure 3: The green electricity promotion system in Austria. ⁹

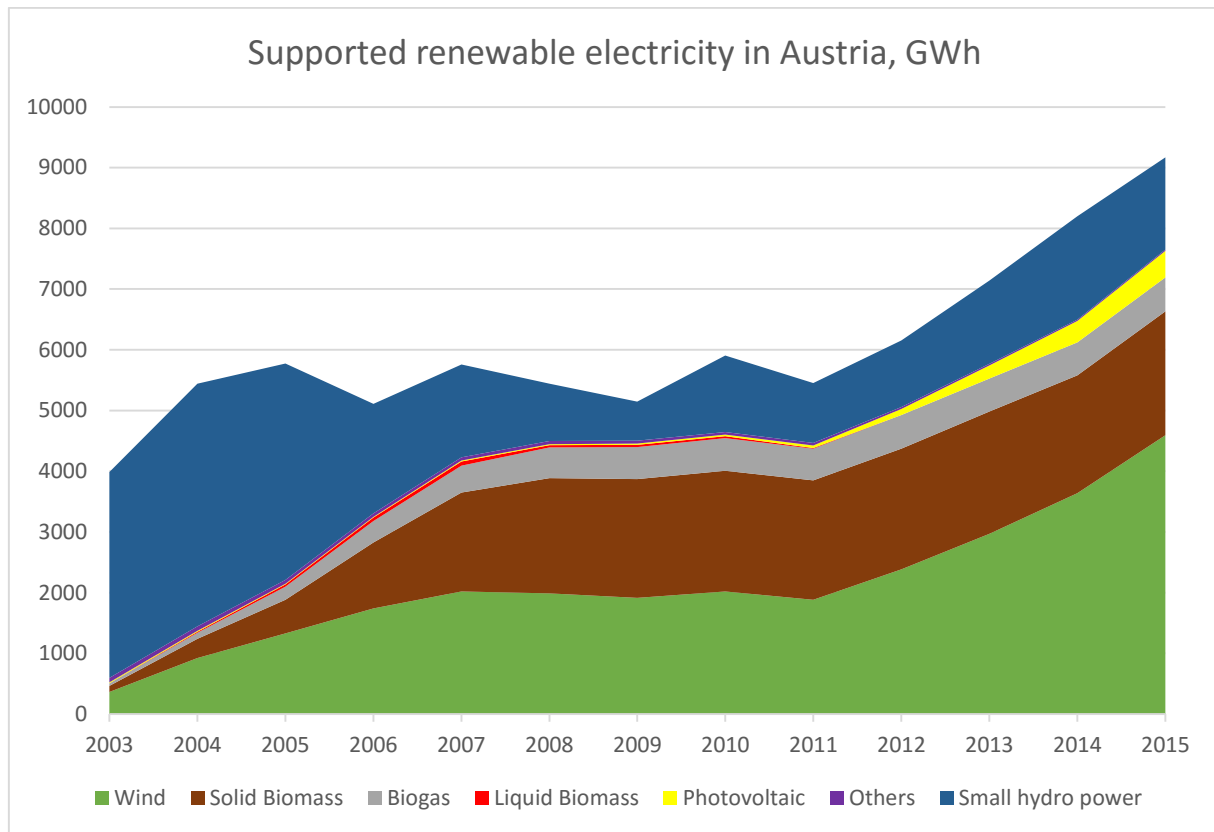
Translation:

Geförderter Ökostrom	Funded green electricity
Ökostromabwicklungsstelle	OeMAG, processing and administration center for green electricity
Bilanzgruppe	Balance group
Stromhändler	Electricity supplier
Endverbraucher	Consumer
Netzbetreiber	Grid operator
Einspeisetarif	Feed-in tariff
Abnahmepreis	Electricity price
Kosten für HKN	Cost for guarantees of origin
Ökostrompauschale und Ökostromförderbeitrag	Green electricity support share and fixed green electricity fee
Mengenfluss Ökostrom	Green electricity flow
Geldfluss	Cash flow

Renewable electricity production

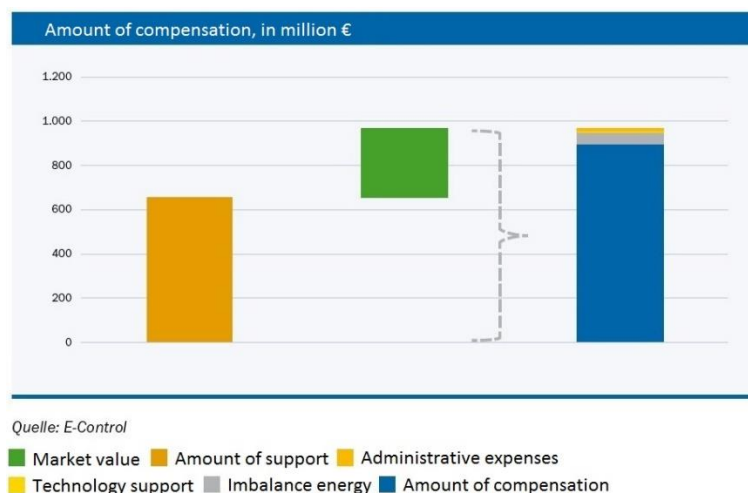
Figure 4 shows that wind power is a driving factor in Austrian RES-E production. The decline of small hydro power in supported electricity happened because the owners opted out of the support and decided to sell their energy on the market. This happened during a time of high electricity market prices.

⁹ Source: <http://www.e-control.at/de/konsumenten/oeko-energie/kosten-und-foerderungen/oekostrom-foerdersystem>

Figure 4: Supported renewable electricity in Austria.¹⁰

Cost

The amount of support for 2015 was 715 million Euros. This is the amount that is directly related to the support of green electricity. It is calculated from the amount of compensation (total amount of feed-in tariffs) minus the market value of the produced electricity plus expenses for imbalance energy, administration and technology support.

Figure 5: Amount of compensation in 2014.¹¹

¹⁰ Source: E-Control, Marktbericht 2015. <http://www.e-control.at/documents/20903/388512/Marktbericht-2015.pdf>

¹¹ Source: <http://www.e-control.at/statistik/oeko-energie/kosten-der-oekostromentwicklung/unterstuetzungsvolumen>

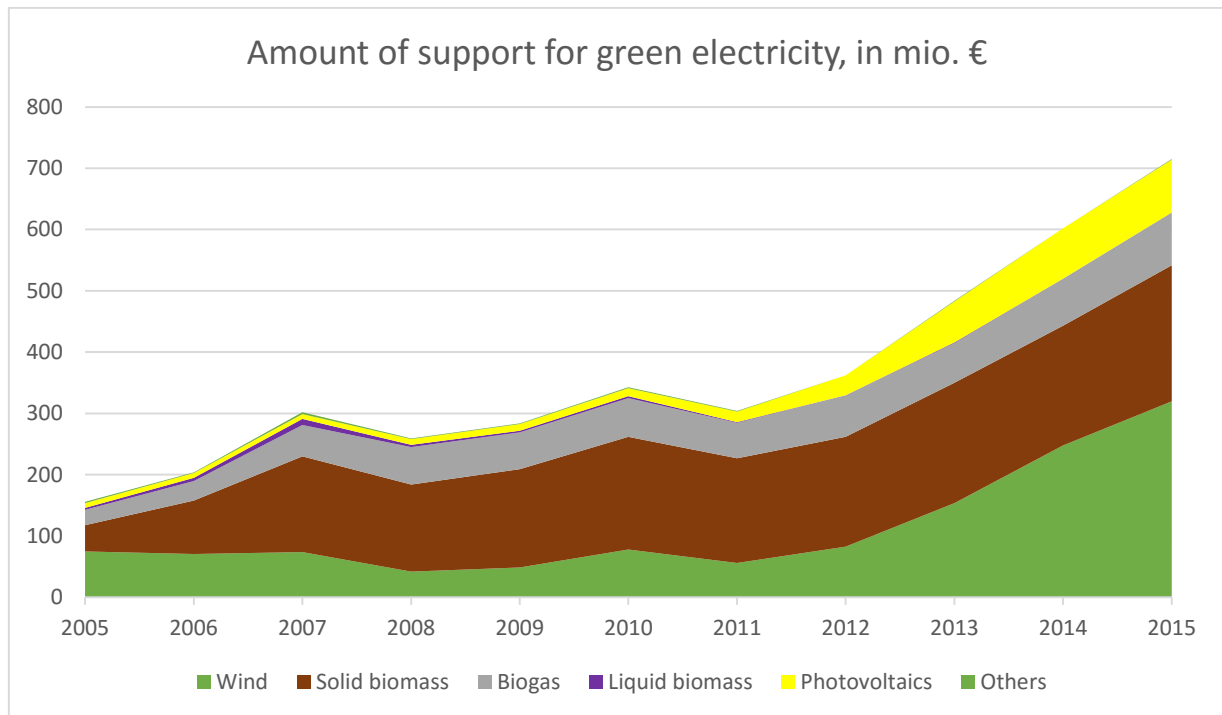
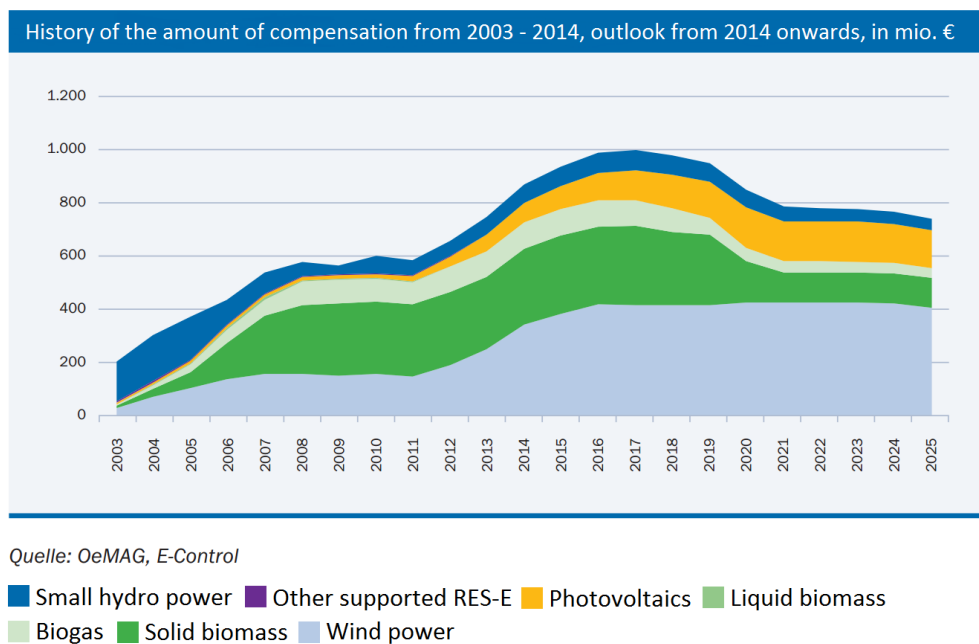


Figure 6: Amount of support for green electricity. Source: <http://www.e-control.at/statistik/oeko-energie/kosten-der-oekostromentwicklung/unterstuetzungsvolumen>



Quelle: OeMAG, E-Control

Small hydro power Other supported RES-E Photovoltaics Liquid biomass
Biogas Solid biomass Wind power

Figure 7: Amount of compensation.¹²

¹² Source: E-Control, Ökostrombericht 2015. <http://www.e-control.at/documents/20903/388512/Oekostrombericht-2015.pdf>

Germany

Germany has an ambitious goal to expand renewable energy and completely abandon nuclear power by the end of 2022. The production of renewable energy in electricity should rise from 27.8% of total consumption in 2014 to at least 35% in 2020. The German Government is aiming to reach at least 50% by 2030, 60% by 2040 and 80% by 2050.

“Federal Republic of Germany Progress report under Article 22 of Directive 2009/28/EC on the promotion of the use of energy from renewable sources” states that the total consumption of energy from renewable sources in Germany “*rose from 15 138 ktoe to 29 734 ktoe (+96 %) in the period from 2005 to 2014. While the electricity sector displayed the highest annual growth rate in the use of renewable energy (approx. 11.5 %), the overall consumption of renewable energy grew by an average of about 7.8 % per year between 2005 and 2014. The total share of renewables in the gross final consumption of energy in Germany in 2014 was 13.8 %, above the 9 forecast value of 12.8 % given in the National Renewable Energy Action Plan (NREAP)*”. Germany is thus on a good way to achieve the ambitious goal for the expansion of renewable energy.

Promotion

In Germany, electricity from renewable sources is mainly supported through feed-in tariffs. Plants for the generation of electricity from renewable sources are given priority connection to the grid. Furthermore, grid operators are obliged to give priority to electricity from renewable sources when purchasing and transmitting electricity. Moreover, those interested in feeding in electricity may demand that the grid operator expands his grid.

The criteria for eligibility and the tariff levels are set out in the “Act on Granting Priority to Renewable Energy Sources” (EEG). The EEG also introduced the “market premium” and the “flexibility premium” for plant operators who directly sell their electricity from renewable sources. Moreover, low interest loans for investments in new plants are provided for by different KfW-Programmes.

The EEG promotes all technologies used to generate electricity from renewable energy, although capacity, location or materials used may give reason for excluding certain types of plants from the support system. [res-legal.eu](http://www.res-legal.eu)¹³ gives a summary of support schemes in Germany:

- The KfW Renewable Energy Programme–Standard provides low-interest loans with a fixed interest period of 10 years including a repayment-free start-up period for investments in installations for electricity production.
- The KfW Programme offshore wind energy provides loans and financing packages to support companies wanting to invest in offshore wind farms in the German Exclusive Economic Zone or in 12 nautical-mile zone of the North and Baltic Sea.
- The KfW Programme Geothermal Exploration Risk covers investment costs connected to drilling activities including the required stimulation measures prescribed by KfW as part of project study.

¹³ <http://www.res-legal.eu/search-by-country/germany/>

- The KfW Financing Initiative Energiewende provides low interest loans for investments in installations for electricity production from renewable energy sources in accordance with the EEG.
- The KfW Renewable Energy Programme Premium provides amongst others low interest loans and grant repayment support (Tilgungszuschuss) for electricity generation in deep geothermal installations.
- Market premium. Plant operators of RES plants exceeding an installed capacity of 500 kW are supported by a market premium for electricity they sell directly. The amount of the market premium shall be calculated each month.
- Feed-in tariff. For power plants up 500 kW the support system is based on a feed-in tariff, which the grid operator pays to the plant operators. The amount of tariff is set by law and is usually paid over a period of 20 years. The plant operators can also opt for the market premium. Plants with a capacity higher than 500 kW can be supported through the feed-in tariff in exceptional cases.
- Flexibility surcharge. The operators of biogas plants that have been commissioned after 1.8.2014 may claim additional support for providing capacity for on-demand use.
- Flexibility premium. The operators of biogas plants that have been commissioned before 1.8.2014 may claim additional support for providing additionally installed capacity for on-demand use.

In 2014 the German government presented a reform of the Renewable Energies Act (EEG). With this reform the continuing expansion of renewable energy sources in the electricity sector can be steered and the momentum of the increase in the overall costs of the expansion of renewable energies can be controlled.

Development

According to Article 22 of Directive 2009/28/EC, every country has to publish a progress report for their development concerning the 2020 goals of renewables. Germany has over-achieved its 2010 target of 12,5% by 5,6% and is making tremendous progress in achieving their 2020 target.

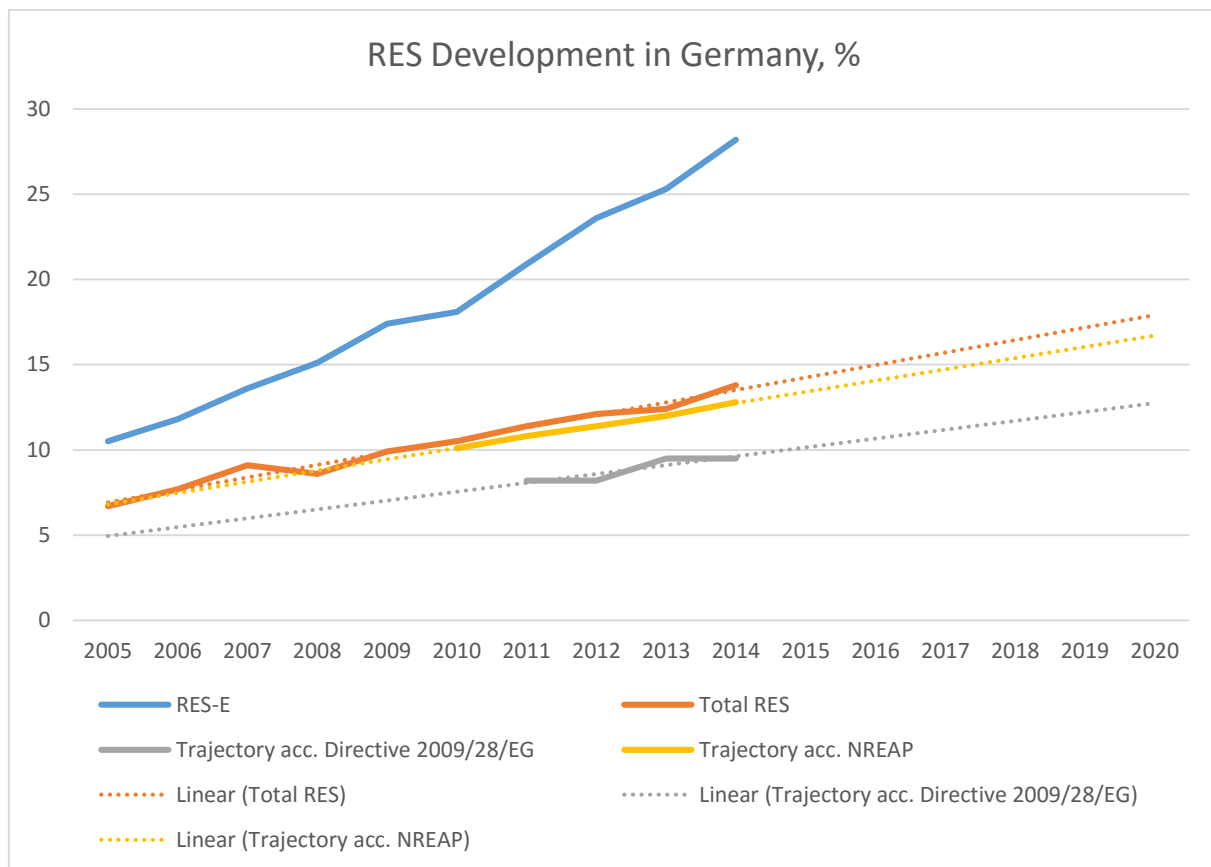


Figure 8: RES development in Germany. ¹⁴

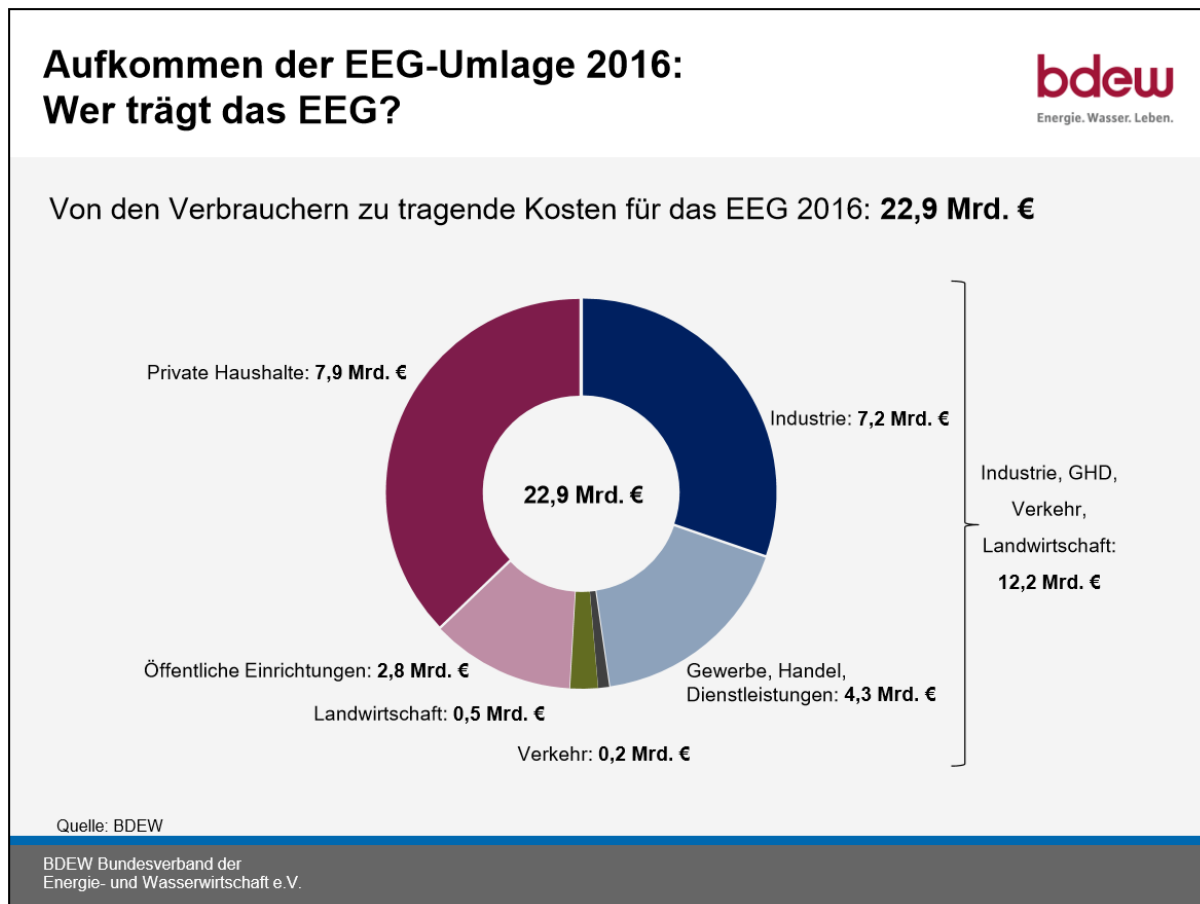
In the year 2014, the most important energy source for RES-E production was wind power with a 35% share. Biomass contributes with a 26% share. Two thirds of this biomass share can be accounted to biogas, thus overtaking hydro power in terms of energy production. Photovoltaics accounts for 22% of RES-E production.

Controversy concerning the EEG

Large, energy-intensive industries are exempted from the allocation of the EEG costs, further burdening private consumers, small and medium businesses. This measure is justified with the global competition the German industry is in. The EEG cost allocation for 2015 was 6,17ct/kWh. That makes yearly costs of about 191€/year for a four-person household without electrical water heating (3100 kWh/year). In Austria, the same household would pay about 80€/year for promotion of renewable energy. The calculation includes more variables than in Germany though: *Fixed green electricity share: 33€/year; Green electricity support share on top of: 1) Grid usage base price: 4,946€/year; 2) Grid usage kilowatt-hour rate: 1,28ct/kWh; 3) Grid usage loss fee: 0,085ct/kWh.*

¹⁴ Source: Fortschrittsbericht nach Artikel 22, Richtlinie 2009/28/EG.
<https://ec.europa.eu/energy/en/topics/renewable-energy/progress-reports>

Cost of the EEG

Figure 9: Allocation of the EEG costs ¹⁵

Who pays for the EEG allocation of 22,9 billion Euros?

- Private households: 7,9 billion Euros
- Industry: 7,2 billion Euros
- Commercial businesses: 4,3 billion Euros
- Public facilities: 2,8 billion Euros
- Agriculture: 0,5 billion Euros
- Transportation: 0,2 billion Euros

¹⁵ Source: BDEW, Erneuerbare Energien und das EEG: Zahlen, Fakten, Grafiken (2016).
[https://www.bdew.de/internet.nsf/res/7BD63123F7C9A76BC1257F61005AA45F/\\$file/160218_Energie-Info_Erneuerbare%20Energien%20und%20das%20EEG_2016_final.pdf](https://www.bdew.de/internet.nsf/res/7BD63123F7C9A76BC1257F61005AA45F/$file/160218_Energie-Info_Erneuerbare%20Energien%20und%20das%20EEG_2016_final.pdf)

Czech Republic

According to the National Action Plan for the Czech Republic's energy from renewable sources by Ministry of Industry and Trade in 2012, the share of energy from renewable sources in gross final energy consumption in 2005 was 6.1%, target of energy from RS in 2020 is 14% and the share of renewable energy in 2012 in the Czech Republic amounted to 11.3%; (Chabrilat, Gillett, Liébard, 2013). Main renewable sources in Czech Republic are solid biomass representing 63%, followed by biofuels with 10%. Others sources arranged in decreasing manner are biogas (8%), hydro (7%), municipal waste and geothermal (each 2%) and wind (1%).

Cost

Financial support from the Czech government for all the installations producing electricity from the renewable sources of energy is estimated on a trillion Czech crowns by 2030. The cost was almost CZK 157 billion between 2011 and 2014. (Supreme Audit Office, 2015) In principle, the grid operators are obliged to bear the costs of the feed-in tariff scheme. In practice however, they pass on the costs arising from the support of renewable electricity generation to the end users. In 2012 the electricity price paid by households is 0,150€ per kWh in contrast to 2014 when there was again a small decrease on the level of 0,127€ per kWh. (Half-yearly electricity and gas prices, second half of year, 2012–14, EUR per kWh)¹⁶

Promotion

Energy sector is one of the most important segments of the Czech Republic's economy and the country in general is the third largest electricity exporter in the European Union, after Germany and France. In 2009 the gross production of electricity from RES had a total amount of 4,655 GWh. (Jirouš, F. 2011) Financial support in the Czech Republic is only defined by the Energy Regulatory Office. Priorities of the National Program to the future are especially increase of usage of alternative fuel in transport and maximization of energy effectiveness and savings.

- Energy Management Act, as amended (406/2006)- Implementing Decree establishing the minimum energy efficiency in the production of electricity and thermal energy (441/2012) and implementing Decree on Energy Audits and Energy Assessments (450/2012)
- **National Energy Efficiency Action Plan of the Czech Republic** pursuant to Article 24(2) of Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency
- **Act No. 165/2012** (Act on promoted energy sources)- contains measures to slow-down the further development of energy from renewable sources while still meeting the EU targets for renewable energy under the burden sharing agreement in compliance with the Renewable Energy Directive
- **Regulation No. 347/2012**- regulation providing technical and economical parameters of renewable sources and lifetime of promoted energy sources

¹⁶ Source: [http://ec.europa.eu/eurostat/statistics-explained/index.php?title=File:Half-yearly_electricity_and_gas_prices,_second_half_of_year,_2012%E2%80%9314_\(EUR_per_kWh\)_YB15.png](http://ec.europa.eu/eurostat/statistics-explained/index.php?title=File:Half-yearly_electricity_and_gas_prices,_second_half_of_year,_2012%E2%80%9314_(EUR_per_kWh)_YB15.png)

The Czech Republic benefits from the presence of a Green Party in its parliament, which actively proposes policies on renewable energy resources. More pressure is exerted by energy investors in the Czech Republic to increase the feed-in tariffs. Feed-in tariffs are a policy mechanism designed to accelerate efforts to improve the competitiveness of renewable energy as a power source.¹⁷ When we compare Slovakia and Czech Republic the feed-in tariffs are almost the same without any huge differences. The amount of tariff differs according to the source of energy in Czech Republic:

Source	Feed-in tariff €ct/kWh
Wind energy	7,3
Solar energy	≤ 5 kW: 11,10 ≤ 30 kW: 9,00
Geothermal energy	12
Biogas	Landfill and sewage gas: 7,10 Biogas plants up to a maximum capacity of 100 kW: 12,9
Hydro-power	Small and reconstructed hydro from 1 January – 31 December 2014: 9,10 Small hydro at new locations from 1 January – 31 December 2014: 11,80
Biomass	The amount of the tariff varies according to the technology used: 4,8-12,1

Figure 10: Feed-in tariffs in the Czech Republic in 2014¹⁸

Targets

National overall targets for the share of energy from renewable sources in gross final consumption of energy in 2005 and 2020:

- A) Share of energy from renewable sources in gross final consumption of energy in 2005 (S 2005) (%) - **6.1**
- B) Target of energy from renewable sources in gross final consumption of energy in 2020 (S 2020) (%) - **13.5**¹⁹

The new act- 2001/77/EC was implemented into the Czech legal system. It adopted support scheme provides a 15-year guarantee of solid feed-in tariffs, differentiated by technology. It is estimated that today's new legislation will lead to the creation of 4,000 new jobs in fuel production and about 23,000 new jobs in the development of associated technologies and engineering.²⁰

¹⁷ Source: <http://www.euractiv.com/section/central-europe/news/slovakia-catching-up-on-green-technologies/>

¹⁸ Source: <http://www.enerdata.net>

¹⁹ Source: Ministry of Economy and Construction of the Czech Republic

²⁰ Source: <http://www.unep.org/GC/GCSS-IX/Documents/Czech-Rep-Theme%201-2-General.pdf>

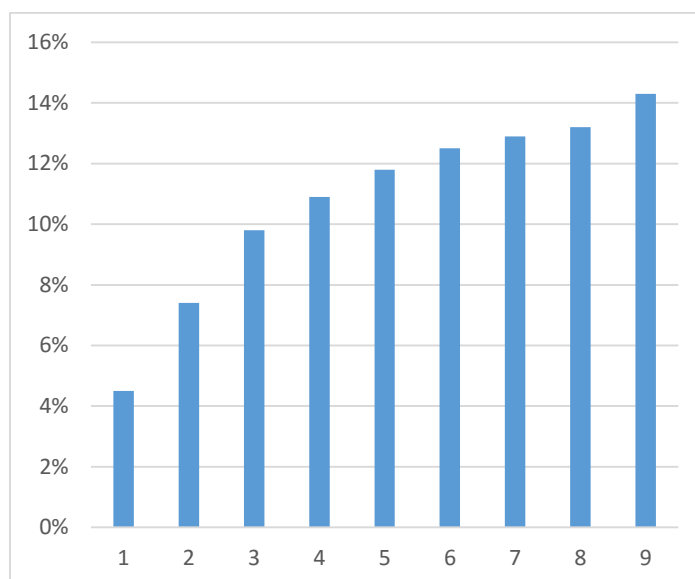


Figure 11: National 2020 target and estimated trajectory of energy from renewable sources in electricity in CZ, 1=2005, 2-8=2010-2016, 9=2020²¹

In 2013 the targets were achieved- 12,75% instead of 11,8% what was planned and also in 2014 the number was higher than 1%.²²

In the Czech Republic there was a rapid raise of the amount of the electricity production from renewable sources of energy.

Table 4: RES-E production in the Czech Republic²³

Year	Water energy	Biomass	Biofuel	Wind energy
2003	1 383	373	108	4
2004	2 019	565	139	10
2005	2 380	560	161	21
2006	2 551	731	176	49
2007	2 090	968	215	125
2008	2 024	1 171	267	245
2009	2 430	1 396	441	288
2010	2 789	1 492	635	335
2011	1 963	1 685	929	397
2012	2 129	1 815	1 468	416
2013	2 735	1 670	2 241	481

²¹ Source: <https://ec.europa.eu/energy/en/topics/renewable-energy/national-action-plans>

²² Source: Report on progress in the promotion and use of energy from renewable sources in the Czech Republic under Art 22 of the European Parliament and Council Directive 2009/28/EC, on support for the use of energy from renewable sources (2013 and 2014) - <https://ec.europa.eu/energy/en/topics/renewable-energy/progress-reports>

²³ Source: http://vitejtenazemi.cz/cenia/index.php?p=obnovitelne_zdroje_energie&site=energie - Obnovitelné zdroje energie

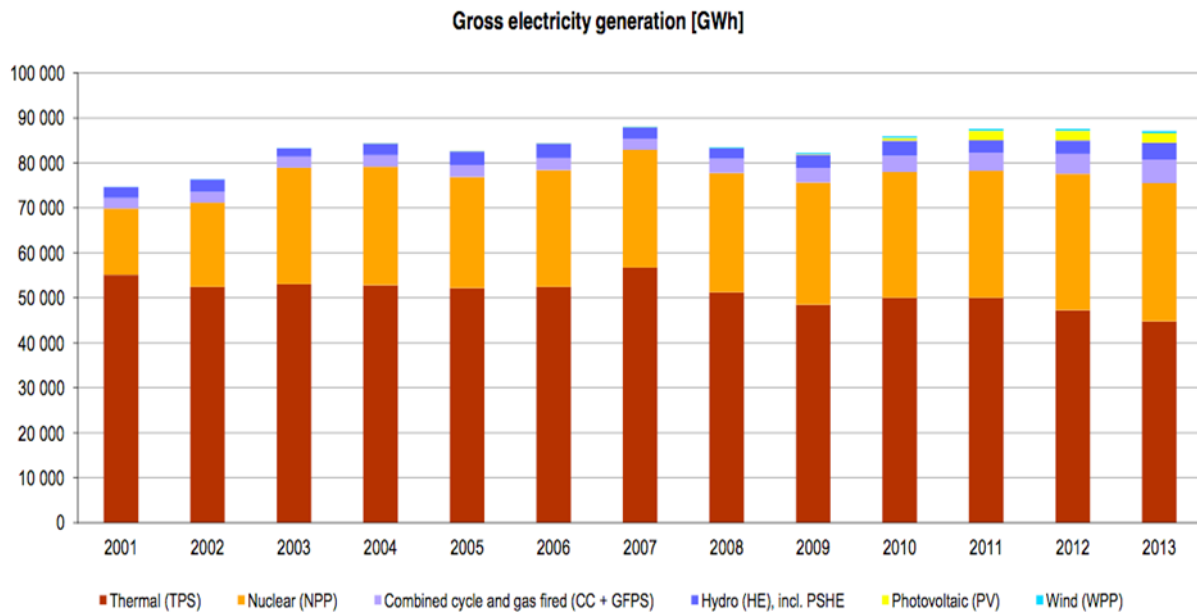


Figure 12: Gross electricity generation in the Czech Republic (2001-2013)²⁴

Excursus: Promotion of PV in the Czech Republic

The breaking point in the promotion of electricity from RES in the Czech Republic was the „Act No. 180/2005 Coll. of 31 March 2005 on the promotion of electricity production from renewable energy sources“, also called the “Act on Promotion of Use of Renewable Sources“. It states two support systems, feed-in tariffs and green bonuses.

Although the “Act on Promotion of Use of Renewable Sources“ deals with all RES, solar energy is the most discussed and controversial one. In Czech Republic the promotion of renewable energy sources is often associated with solar boom and especially with price increases.

The Czech Republic has long supported photovoltaics through either guaranteed feed-in tariffs (see figure) or green bonuses. The feed-in tariffs are guaranteed purchase prices that are announced each year by the Energy Regulatory Office and are fixed for 20 years with a regular annual increase of 2%. One of the major energy distributors (ČEZ, E.ON, PRE) is obliged to buy the offered energy. The Green bonus is fixed for one year only. It is a financial subsidy to the produced electricity. The plant operator can sell the energy at any price or consume it himself.

Costs of solar technology decreased, feed-in tariffs remained high

In the years 2008-2010 there was a sharp decline of the PV technology prices. The decrease in investment costs for solar technology was primarily related to the increased supply of Chinese PV modules. In this period there has been a boom of the construction of solar power plants.

In the table the development of the installed PV capacity in the years 2006-2012 can be observed. For example, while in 2009 compared to 2008 the total installed capacity of solar power plants rose by 425,1 MW, in 2010 the installed capacity compared to 2009 rose by a total of 1.494,5 MW. According to a calculation by the Energy Regulatory Office, in 2012 PV plants with an installed capacity of 2.086

²⁴ Source: 4liberty.eu

MW had a 10,2% share of the total installed capacity in the Czech Republic. This puts it in the third place behind the steam and the nuclear power plants.

The problem in the promotion of PV was the delayed reaction of the state to adequately and timely reduce the amount of aid. The cost of supporting PV energy increased proportionally to the increasing installed capacity of the PV plants.

Table 1: Development of the installed PV capacity in the years 2006-2012 (source: Energetický regulační úřad (ERÚ) - Energy Regulatory Office)

Year	Installed capacity of new PV power plants (MW)
2006	0,2
2007	3,4
2008	39,5
2009	464,6
2010	1959,1
2011	1971
2012	2086

The solar boom ended, but...

The Czech government responded to the situation only in September 2010, when it greatly limited the support for newly built solar power plants. The solar boom ended, but this did not change the fact that the state has to meet its obligations to the owners of the existing solar power plants. For example, PV power plants built by the end of 2010 have further guaranteed feed-in tariffs for a period of 20 years.

Since 2014 the support for PV in the Czech Republic ended for good.

Solar tax and conflict

In 2010 in response to the solar boom a solar tax was introduced. This tax affects PV power plants with an installed capacity of over 30 kW put into operation in the period from 1st January 2009 to 31st December 2010. The tax makes 26% of the feed-in tariff for the period from 2011 to 2013 and further 10% of the feed-in tariff from 2013 for an indefinite period of time.

The investors in PV consider the solar tax a scam from the state and filed a criminal complaint against the Energy Regulatory Office.

Sources:

„Act No. 180/2005 Coll. of 31 March 2005 on the promotion of electricity production from renewable energy sources“

https://cs.wikipedia.org/wiki/Podpora_výroby_elektřiny_z_obnovitelných_zdrojů_v_České_republice#cite_ref-eru_1-0

<http://www.penize.cz/nakupy/275131-jak-to-bylo-a-je-s-fotovoltaikou-v-cesku>

Slovakia

Since 1997 the original 15 EU member states launched to draw up scenarios providing that in the year 2010 renewable energy should cover 12% of EU energy consumption. (Eurostat, 2015) Liabilities for individual Member States (e.g. national indicative targets) are defined by the European Directive 2001/77 / EC. Since 1st May 2004 the new member states joined the EU, the overall target for all EU countries was supposed to be a 21% share of electricity from RES of the total consumption in the year 2010 and the goal for Slovak republic was 31%.

On the basis of Article 4. 3 Directive. 2009/28 / EC, Slovak Republic publishes this document with the forecast, which illustrates the estimated amount of energy from renewable energy sources (RES), as well as its estimated potential for joint projects until 2020. Slovakia is in accordance with Annex 1 obligated to increase the use of renewable energy in proportion to the gross final energy consumption from 6.7% in 2005 to 14% in 2020, whereas in 2012 it reached 10,6%.²⁵

Expected amount of energy from renewable sources corresponding the aim 14% by the year 2020 was calculated from the Expected total adjusted energy consumption. Slovak primary legislation comprises Law no. 656/2004 Coll. Energy Act. This law defines the basic processes related to electricity and renewable energy.

Cost

The costs of the support scheme are only given by the consumers, through their electricity bills. There is no specific provision for the costs to be passed on to the consumers. In 2012 the electricity price paid by households as 0,172€ per kWh whereas in 2014 was seen a slightly decrease on the level of 0,152€ per kWh.²⁶ Almost 374€ is paid each year by an average household in comparison to 60,8€ of state intervention in the sector of energy.

Promotion

The promotion of electricity produced from renewable energy sources is a high priority of Community as it is written for instance in the *White Paper on Renewable Energy Sources* for many reasons- economic and social cohesion, environmental protection or security.

- **National Renewable Energy Action Plan**- the plan provides detailed map of how the Member State expected to reach its legally binding 2020 target for the share of renewable energy in their total energy consumption, as required by Article 4 of the Renewables Directive
- **Act No 309/2009** on the promotion of RES was approved by Parliament on 19 June 2009- optimizes the functioning of the electricity market in the field of renewable energy sources and combined heat and power generation, and creates a stable economic and administrative environment

²⁵ Source: ec.europa.eu- Share of RES in the final energy consumption

²⁶ Source: [http://ec.europa.eu/eurostat/statistics-explained/index.php?title=File:Half-yearly_electricity_and_gas_prices,_second_half_of_year,_2012%E2%80%9314_\(EUR_per_kWh\)_YB15.png](http://ec.europa.eu/eurostat/statistics-explained/index.php?title=File:Half-yearly_electricity_and_gas_prices,_second_half_of_year,_2012%E2%80%9314_(EUR_per_kWh)_YB15.png)

- RES Act (**Act No. 309/2009** Coll. on the Support of Renewable Energy Sources)- the promotion of renewable energy sources and high-efficiency cogeneration and on amendments to certain laws
- Energy Act (**Energy Act No. 656/2004 Coll.**)- on the promotion of renewable energy sources and high-efficiency cogeneration and on amendments to certain acts

Slovak legislation does not set an overall goal or objectives for each technology to be achieved in the individual years.

The Slovak republic uses a feed-in tariff system in the promotion of renewable electricity. Energy companies are obliged to purchase and pay for electricity transmitted to the grid. Currently, the Slovak Republic conducts a professional training programme for RES-installers and there are RES-H building obligations. The electricity capacity lies at 7,9 GW in 2013 out of which 2,6 GW- about 1/3 are hydropower plants. In 2012, most of the renewable energy generated in Slovakia came from solid biomass, which accounted for 0.7% contribution to the EU-27 and in the first place with the contribution to the EU-27 was hydro energy in the amount of 391 ktoe, which represented 1,3%. The highest feed-in tariff is for geothermal energy- 15,513€ per kWh, the lowest belongs to energy produced from the wind- 7,03€ per kWh but all numbers depend on the capacity which was used.

Source	Feed-in tariff €/kWh
Wind energy	7,03
Solar energy	9,894
Geothermal energy	15,513
Biogas	Landfill gas or sewage gas: 7,034
	<i>Biomethane produced from biogas using anaerobic digestion</i>
	Capacity of 1 MW: 10,753
	<i>Biogas plants using anaerobic digestion</i>
	Capacity of <250 kW: 12,529
	Capacity from 250 kW – 500 kW: 11,941
	Capacity from 500 kW – 750 kW: 11,062
Capacity of >750 kW: 10,726	
Hydro-power	Biogas produced through thermochemical conversion: 12,262
	Biogas produced through anaerobic digestion of bio-degradable waste: 11,888
	up to 100 kW: 11,127
	from 100 to 200 kW: 10,917
	from 200 to 500 kW: 10,684
Biomass	from 500 kW to 1 MW: 10,515
	from 1 MW to 5 MW: 9,798
	Designated biomass: 9,209
	Other biomass from waste: 10,063
	Biomass from straw: 12,61
	Bioliqids: 9,436

Figure 13: Feed-in tariffs in Slovakia in 2014²⁷

Targets

National overall targets for the share of energy from renewable sources in gross final consumption of energy in 2005 and 2020:

²⁷ Source: RES LEGAL Europe, 2015

- a) Share of energy from renewable sources in gross final consumption of energy in 2005 (S 2005) (%) - 6.7%
- b) Target of energy from renewable sources in gross final consumption of energy in 2020 (S 2020) (%) - 14.0%²⁸

The total amount of electricity produced using hydropower during this period has been affected especially by climatic conditions. There was a significant increase in electricity produced using biomass as a result of new plants and also due to raising production of the existing ones.²⁹

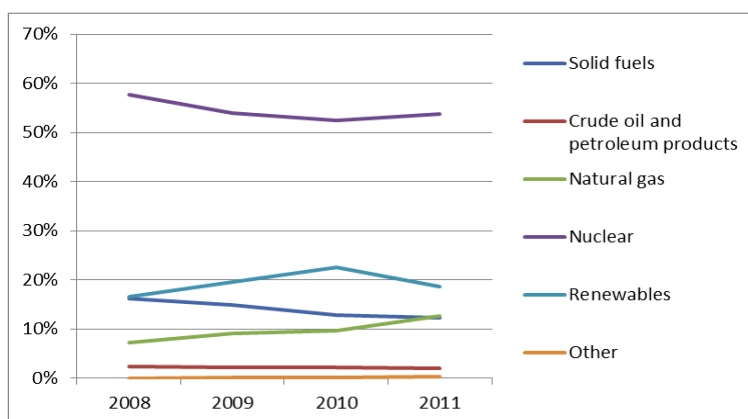


Figure 14: Gross electricity generation mix in Slovakia 2008-2011³⁰

National 2020 target and estimated trajectory of energy from renewable sources in electricity:

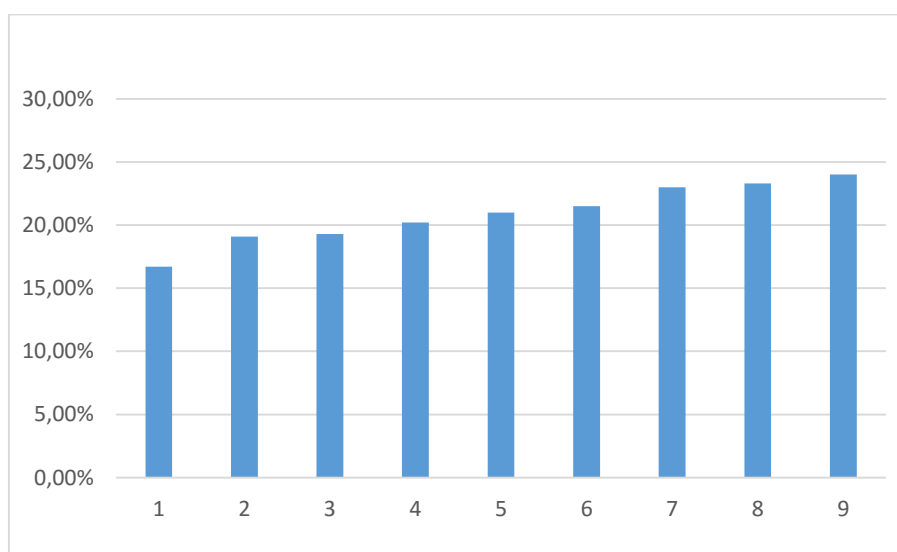


Figure 15: National 2020 target and estimated trajectory of energy from renewable sources in electricity, 1=2005, 2-8=2010-2016, 9=2020³¹

In 2013 the targets were achieved - 21,1% instead of 21,0% what was planned and also in 2014 the number was 1,5% higher.

²⁸ Source: Ministry of Economy and Construction of the Slovak Republic

²⁹ Source: <http://ec.europa.eu/energy/en/topics/renewable-energy/progress-reports>

³⁰ Source: https://ec.europa.eu/energy/sites/ener/files/documents/2014_countryreports_slovakia.pdf

³¹ Source: <https://ec.europa.eu/energy/en/topics/renewable-energy/national-action-plans>

Comparison of wholesale prices

This figure shows the wholesale electricity prices on the European market in 2013. As can be seen, the prices in Austria, Germany, Czech Republic and Slovakia are approximately the same at around 33€/MWh. “In countries like Germany, where the influence of solar and wind power generation rapidly increased during the last couple of years, abundant renewable supply assured one of the lowest average price in 2013 in the EU. German power generation trends have significantly impacted the price level in Central and Eastern Europe.”³²

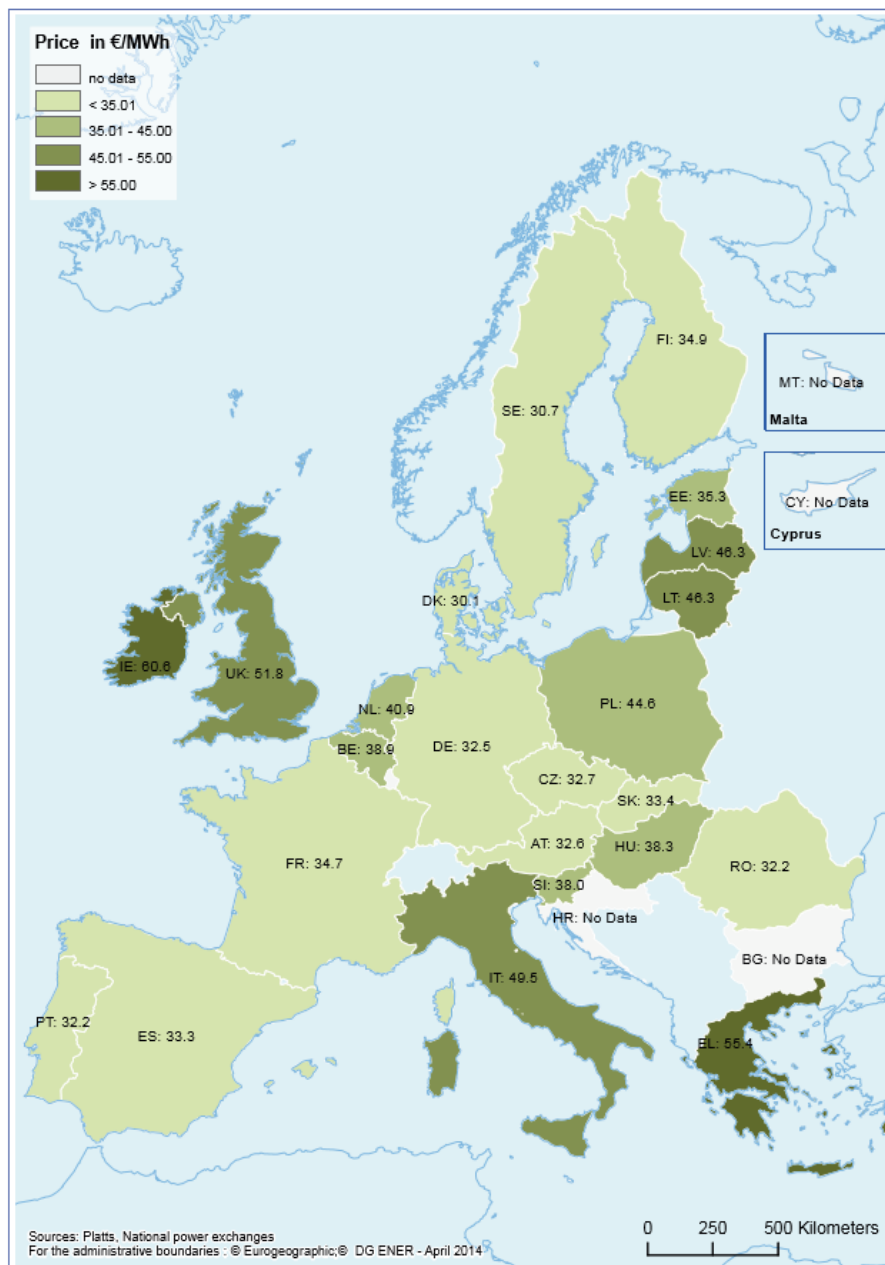


Figure 16: Annual averages of day-ahead wholesale baseload electricity prices in 2013.³³

³² „EU Energy Markets in 2014“, European Commission.

https://ec.europa.eu/energy/sites/ener/files/documents/2014_energy_market_en_0.pdf

³³ „EU Energy Markets in 2014“, European Commission.

https://ec.europa.eu/energy/sites/ener/files/documents/2014_energy_market_en_0.pdf

Conclusions

The following table lists the share of electricity from renewable sources in gross electricity consumption.

Table 5: Share (%) of electricity from renewable sources in gross electricity consumption. ³⁴

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
European Union (28 countries)	14,9	15,4	16,1	17,0	19,0	19,7	21,7	23,5	25,4	27,5
Austria	62,4	62,4	64,6	65,2	67,8	65,7	66,0	66,5	68,0	70,0
Czech Republic	3,7	4,0	4,6	5,2	6,4	7,5	10,6	11,6	12,8	13,9
Germany	10,5	11,8	13,6	15,1	17,4	18,1	20,9	23,6	25,3	28,2
Slovakia	15,7	16,6	16,5	17,0	17,8	17,8	19,3	20,1	20,8	23,0

Compared to the 2010 targets (78,1; 8; 12,5; 31 for Austria, Czech Republic, Germany and Slovakia respectively) it is clear that only Germany reached its target. That is also stated in the Communication 2011/31 from the Commission: *“Only a few Member States, namely Denmark, Germany, Hungary, Ireland, Lithuania, Poland and Portugal expect to achieve their 2010 targets for renewable energy in electricity generation. “*

The Communication further explains why this development led to a change of policy:

“The inadequate rate of progress towards agreed targets, and the need to foster renewable energy development in all Member States and not only in a few, were among the reasons that prompted a change in policy approach marked by the adoption of the Renewable Energy Directive in 2009. The new Directive covers energy consumption as a whole, including for heating and cooling, and lays down legally binding rather than indicative national targets such that the EU achieves a 20% share of renewable energy by 2020. “

Some of the measures required to be conducted by the member states concerning Directive 2009/28/EC are:

„It also contains a much reinforced set of provisions to facilitate the development of renewable energy, such as a legal requirement for the Member States to prepare National Renewable Energy Action Plans, reform planning regimes, and develop electricity grids. “

Concerning these RES-E goals for 2020, Germany is most likely going to achieving them (see figure 8, RES development in Germany).

Also Austria is on the right path to achieving its 2020 goal at 34% RES in total consumption with a share of 33% by 2014. The 2010 target for RES-E might have been too ambitious, starting from an already high level.

³⁴ Source: http://ec.europa.eu/eurostat/statistics-explained/index.php/Energy_from_renewable_sources

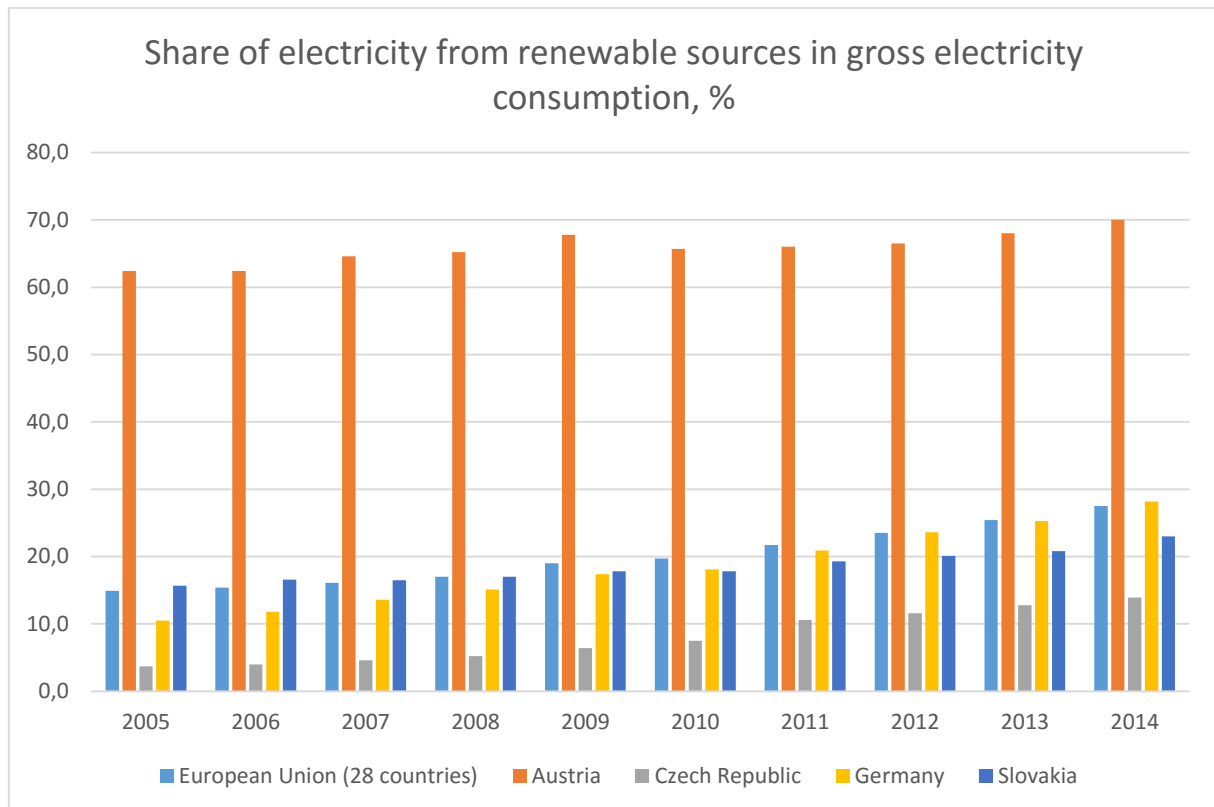


Figure 17: Share of electricity from renewable sources in gross electricity consumption. ³⁵

Austria:

- Didn't reach (ambitious) 2010 target of 78,1% (2010: 65,7%)
- Will reach 2020 target of 70,6% (2014: 70,0%)

Germany:

- Easily reached 2010 target of 12,5% (2010: 18,1%)
- Will probably reach (ambitious) 2020 target of 38,6% (2014: 28,2%)

Czech Republic:

- Slightly missed 2010 target of 8% (2010: 7,5%)
- Will reach 2020 target of 14,3% (2014: 13,9%)

Slovakia:

- Failed to reach 2010 target of 31% (2010: 17,8%)
- Will reach 2020 target of 24% (2014: 23%)

³⁵ Source: http://ec.europa.eu/eurostat/statistics-explained/index.php/Energy_from_renewable_sources

Table index

Table 1: National indicative targets for Austria, Czech Republic, Germany and Slovakia.	5
Table 2: Renewable energy targets for 2020.	6
Table 3: RES-E targets according to the National Renewable Energy Action Plans.	6
Table 4: RES-E production in the Czech Republic.....	20
Table 5: Share (%) of electricity from renewable sources in gross electricity consumption.	27

Figure index

Figure 1: National indicative targets for all EU member states. RES-E % in 2010.....	5
Figure 2: Main promotion strategies of the EU countries (source: RE-SHAPING, 2011)	7
Figure 3: The green electricity promotion system in Austria.	11
Figure 4: Supported renewable electricity in Austria.....	12
Figure 5: Amount of compensation in 2014.	12
Figure 6: Amount of support for green electricity. Source: http://www.e-control.at/statistik/oeko-energie/kosten-der-oekostromentwicklung/unterstuetzungsvolumen	13
Figure 7: Amount of compensation.....	13
Figure 8: RES development in Germany.	16
Figure 9: Allocation of the EEG costs	17
Figure 10: Feed-in tariffs in the Czech Republic in 2014	19
Figure 11: National 2020 target and estimated trajectory of energy from renewable sources in electricity in CZ, 1=2005, 2-8=2010-2016, 9=2020.....	20
Figure 12: Gross electricity generation in the Czech Republic (2001-2013)	21
Figure 13: Feed-in tariffs in Slovakia in 2014	24
Figure 14: Gross electricity generation mix in Slovakia 2008-2011	25
Figure 15: National 2020 target and estimated trajectory of energy from renewable sources in electricity, 1=2005, 2-8=2010-2016, 9=2020	25
Figure 16: Annual averages of day-ahead wholesale baseload electricity prices in 2013.	26
Figure 17: Share of electricity from renewable sources in gross electricity consumption.	28