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THE EUROPEAN WIND ENERGY ASSOCIATION

Avoiding fossil fuel costs with wind energy

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Avoiding fossil fuel costs with wind energy

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Key findings and policy recommendations

During 2011 Europe spent €406 billion (bn) on importing fossil fuels[1] rising to €545 bn in 2012[2]. This is around three times more than the cost of the Greek bailout up to 2013[3]. Europe imports over half its energy in the form of fossil fuels, resulting in exposure to volatile fossil fuel prices. This dependency is set to increase according to the European Commission if decarbonisation of the power sector is not accelerated[4]. Wind energy offers a valuable solution to this crisis because it replaces costly fossil fuel imports.

But how much money do we avoid spending on fossil fuels by increasing our wind energy consumption?

Avoided fuel costs from wind

- In 2012, wind energy avoided €9.6 billion (bn) of fossil fuel costs[5].
- Depending on the decarbonisation scenario assumed for the future, wind energy will avoid between €22 bn and €27 bn of fuel costs annually in 2020, increasing to between €47 bn to €51 bn in 2030[6].

1 "Energy Challenges and policy" Commission contribution to the European Council of 22 May 2013

2 European Commission, Energy economic developments in Europe, January 2014 http://ec.europa.eu/economy_finance/publications/european_economy/2014/pdf/ee1_en.pdf

3 Greece has received 148.6 billion euros in EU/IMF funds from May 2010 up to 2013. (Source: Reuters.com: http://uk.reuters.com/article/2012/11/13/uk-greece-factbox-bailout-idUK-BRE8AC0KE20121113)

4 European Commission "Energy Roadmap 2050 Impact Assessment and scenario analysis". SEC(2011) 1565 final. Brussels, 15.12.2011

5 Including domestic and fuel imports and assuming 2010 thermal generation from the Reference scenario of the Energy Roadmap 2050 , wind energy generation of year 2012 from EWEA "Pure Power" report (2011) and Brent oil prices in 2012 from US EIA

6 Ranges taken from Current Policy Initiatives (CPI) and High Renewables (HighRES) scenarios of the "Energy Roadmap 2050 impact assessment and scenario analysis"

Policy recommendations

- Set a binding EU 2030 renewable energy target to help replace more fossil fuels with wind energy by providing a stable regulatory framework
- Ensure the European Emission Trading System (ETS) provides a high and stable carbon price to disincentivise investment in fossil fuel generation
- Ensure public investment in wind energy R&D to develop and increase the competitiveness of wind energy so that its market share grows
- Build up and out the power grid to ensure Europe is joined up and wind energy can be transmitted to consumers wherever needed
- Set a minimum emission performance standard for all new-build power installations.

The EU's 2030 climate and energy policy framework

In its communication on "a policy framework for climate and energy in the period from 2020 to 2030"[7], published on 22 January the European Commission proposes increasing renewable energy penetration to 27% of consumption in the EU by 2030, up from an expected 20% in 2020.

This unambitious target was proposed despite the Commission's own impact assessment[8] showing the economic benefits of a higher renewable energy target, including the avoidance of fossil fuel imports.

The 27% renewable energy target for 2030 proposed by the European Commission would result in fossil fuel import savings of €190bn over the 20 year period of 2011-2030. However, a 30% renewable energy target would save €450 billion in imported fuels costs between 2011 and 2030, €22.5bn a year. A 30% renewable energy target would, therefore, save €260 billion more in avoided fuel import costs between 2011 and 2030 than a 27% target, €13bn a year more.

According to the European Commission[9], in 2010 renewables avoided €30bn in imported fuel costs. During the same year, the IEA estimates that cost of support for renewable energy in the EU was €26bn[10], highlighting that the cost of supporting renewable energy is offset by the avoided costs of importing fossil fuels alone.

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7 January 2014

8 European Commission Impact Assessment. SWD(2014) 15 final http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=SWD:2014:0015:FIN:EN:PDF

9 Commission staff working document, Energy Economic Developments in Europe, January 2014

10 IEA World Energy Outlook, 2011

Introduction

Fossil fuel prices are volatile and, as the European Commission (EC) and the International Energy Agency (IEA) predict, they will increase over the next decades[11]. Wind power does not require costly fuel to produce energy, and therefore its electricity generation is not exposed to these fuel price increases and volatility.

Wind energy reached over 106 GW of installed capacity in 2012, capable of producing over 230 TWh of energy - equivalent to 7% of the EU's electricity consumption. According to the European Commission's Energy Roadmap 2050, wind energy could meet 15% of EU electricity consumption in 2020 and 22% in 2030, which is similar to EWEA's own forecasts[12].

Replacing energy generation from fossil fuels with wind energy would reduce both dependency on domestic and imported fuel – lowering the fuel import bill - and greenhouse gas (GHG) emissions.

This EWEA analysis looks at two scenarios from the European Commission's Energy Roadmap 2050: one with high share of renewable energy and lower fossil fuel prices, and the second with no new energy policies and higher fossil fuel prices. While our analysis is not exhaustive, it provides an insight into the benefits of wind energy[13].

SCENARIOS: BASED ON THE EC ENERGY ROADMAP 2050, TWO SCENARIOS USING TWO FUEL PRICE CASES WERE CONSIDERED:

Scenarios	Abbreviation in this report
1. High renewables + reference fuel prices	HRRP
2. Current policy initiative (no new policies) + high fuel prices	CPHP

[11] Energy Roadmap 2050 and World Energy Outlook 2012

[12] European Commission, 2013. EU energy, transport and GHG emissions trends to 2050, reference scenario 2013, p.44. and EWEA, 2011. Pure Power, wind energy targets for 2020 and 2030

[13] See annex for detailed methodology

Prices and consumption of fossil fuels

The Reference scenario from the Energy Roadmap 2050 estimates increases in all fossil fuel prices between 2010 and 2030[14]. Between 2012[15] and 2030, coal prices increase by 34% assuming reference prices, and by 88% assuming high prices. Similarly, gas prices increase by 16% and by 54% respectively, while oil prices, on the other hand, decrease by 5% assuming reference prices and increase by 34% assuming high prices.

TABLE 1 FOSSIL FUEL PRICES – REFERENCE PRICES (CONSTANT USD$2008/BOE)

Fossil fuel	2012*	2015	2020	2025	2030	Difference 2012/2020
Oil	111.7	100	88.4	97.1	105.9	- 5%
Gas	65.7	63.9	62.1	69.4	76.6	+ 16%
Coal	24.3	26.5	28.7	30.7	32.6	+ 34%

Sources: European Commission (2011) and *US EIA (2013)

TABLE 2 FOSSIL FUEL PRICES – HIGH PRICES (CONSTANT USD$2008/BOE)

Fossil fuel	2012*	2015	2020	2025	2030	Difference 2012/2020
Oil	111.7	121.9	132.2	140.7	149.3	+ 34%
Gas	65.7	75.7	85.5	93.5	101.5	+ 54%
Coal	24.3	31.8	39.3	42.5	45.7	+ 88%

Sources: European Commission (2011) and *US EIA (2013)

[14] European Commission "Energy Roadmap 2050 Impact Assessment and scenario analysis". SEC(2011) 1565 final. Brussels, 15.12.2011

[15] Using the US energy information administration price for Brent Oil of USD$ 111.7/boe in 2012 (http://www.eia.gov/todayinenergy/detail.cfm?id=9530) and the 2010 price ratios from the EC Energy Roadmap 2050, p.55 and 56

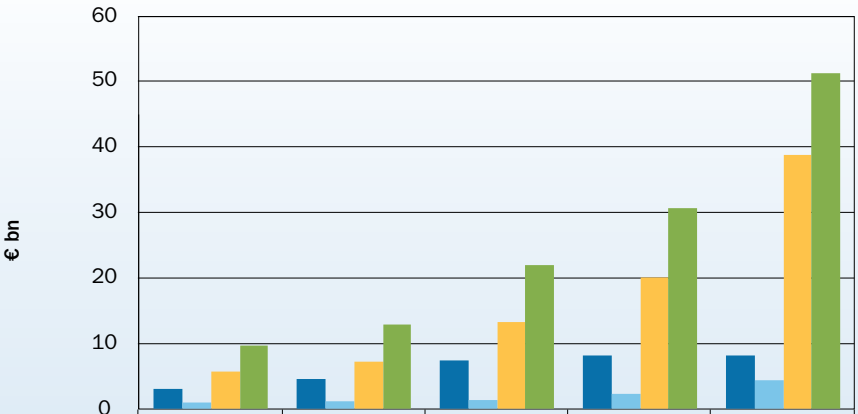
Avoided fuel costs from wind energy

In 2012, wind energy avoided €9.6 bn of fossil fuels costs[16]. The European Commission has calculated that renewable energy avoided fuel imports worth €30 bn in 2010[17]. As the EU imports just over half of its energy needs, avoided fuel costs from wind energy represents over one sixth of the EU's total avoided fuel import bill.

In the HRRP scenario, wind avoids almost €22 bn in fuel costs in 2020, increasing to over €51 bn in 2030. This means, had wind power not been present in the generation mix in those years, the EU would have to spend €22 bn and over €51 bn additionally to the annual total fuel costs in 2020 and 2030.

The total fuel costs in this scenario amount to almost €62 bn in 2020 and €53 bn in 2030. The avoided fuel costs from wind represent 36% and 96% of these total fuel costs (see annex for more information).

FIGURE 1 ANNUAL FUEL COSTS AVOIDED BY WIND POWER, HRRP SCENARIO (€ bn)



	2012	2015	2020	2025	2030
Coal	2.8	4.4	7.4	8.2	8.0
Oil	1.0	1.1	1.2	2.2	4.3
Gas	5.6	7.2	13.2	20.1	38.9
Total	9.6	12.8	21.9	30.6	51.3

Sources: EWEA (2011), European Commission (2011) and EIA (2013)

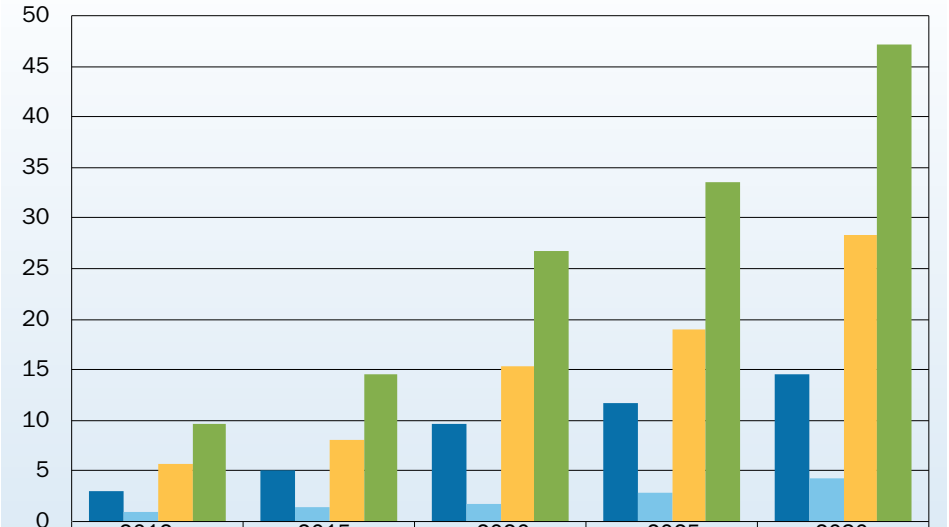
[16] Including domestic and fuel imports and assuming 2010 thermal generation from the Reference scenario of the Energy Roadmap 2050 , wind energy generation of year 2012 from EWEA "Pure Power" report (2011) and Brent oil prices in 2012 from US EIA

[17] European Commision "Impact assessment for a 2030 climate and energy policy framework" (2013)

Using the CPHP scenario, wind energy annually avoids around €27 bn in 2020 and €47 bn in fuel costs in 2030. Again, this means that had wind power not been present in the generation mix in these years, the EU would have to spend additionally these amounts to the total fuel costs.

Total fuel costs in this scenario amounts to €89 bn in 2020 and €97 bn in 2030. The avoided fuel costs from wind represent 30% and 49% these total fuel costs.

FIGURE 2 ANNUAL FUEL COSTS AVOIDED BY WIND POWER, CPHP (€ bn)



	2012	2015	2020	2025	2030
Coal	2.9	5.0	9.7	11.7	14.5
Oil	1.0	1.3	1.7	2.8	4.3
Gas	5.6	8.1	15.3	18.9	28.3
Total	9.6	14.5	26.7	33.6	47.2

Sources: EWEA (2011), European Commission (2011) and EIA (2013)

Annex

The amount of avoided fuel costs depends on assumptions of future fuel prices - highly determined by supply and demand of electricity - and the level of wind energy deployment. The European Commission's Energy Roadmap 2050 uses five decarbonisation scenarios for the possible development of the EU's energy mix, including wind energy deployment, and three possible cases for the evolution of fuel prices if decarbonisation scenarios are not realised: a reference prices, a high and a low prices case[18].

This EWEA analysis combines the reference and high fuel price cases with the Current Policy Initiatives (CPI) and the High Renewables (HighRES) scenarios. While our analysis is not exhaustive, it provides an insight into the benefits of wind energy.

In the HighRES scenario, the Commission estimates that total fossil fuel consumption will decrease by 32% between 2010 and 2030. In contrast, according to the CPI scenario (whereby the EU adopts no new energy policies) consumption will decrease by just 12% over the same period.

With the high levels of wind energy in the HighRES scenario, it is possible to assume that fossil fuel prices do not increase, as the EU would depend less on those fossil fuels so low demand would keep prices down. Consequently, in this analysis, the HighRES scenario is combined with the reference fuel price case (HRRP Scenario).

Conversely, if the deployment of renewables does not accelerate, fossil fuel prices would increase. In this analysis, this second scenario is captured by taking the CPI scenario with high fossil fuel prices (CPHP scenario).

SCENARIOS: BASED ON THE EC ENERGY ROADMAP 2050, TWO SCENARIOS USING TWO FUEL PRICE CASES WERE CONSIDERED:

Scenarios	Abbreviation in this report
1. High renewables + reference fuel prices	HRRP
2. Current policy initiative (no new policies) + high fuel prices	CPHP

[18] Fuel prices in the European Commission Roadmap are analysed as 'sensitivities' on the Reference Scenario. In this report we use the term 'cases' for simplicity

Replacing a mix of fossil fuels with wind energy

Wind energy generation replaces a mix of energy sources, mostly fossil fuels. Assuming that wind energy displaces only electricity from fossil fuel thermal plants, not base load plants (in line with EWEA previous findings on the Merit Order Effect)[19], avoided fuel costs from the energy replaced by wind energy can be calculated using the formula below.

Avoided fuel cost =

$$= \left[\frac{\text{Wind power generation}}{\text{Total thermal generation}} \times \text{Total fuel input}\right] + \left[\frac{\text{Fuel input}}{\text{Total fuel input}}\right] + \left[\text{Fuel price}\right]$$

1. 2. 3.

Where:

1. $\left[\frac{\text{Wind power generation}}{\text{Total thermal generation}} \times \text{Total fuel input}\right]$ is the total fuel inputs avoided by wind energy generation

2. $\left[\frac{\text{Fuel input}}{\text{Total fuel input}}\right]$ is the % of the specific fuel input (coal, oil, gas) in the generation mix for thermal generation to be priced

3. $\left[\text{Fuel price}\right]$ is the price of each fuel input in the reference and high prices cases of each year

[19] Wind energy and electricity prices. Exploring the merit order effect. April 2010. http://www.ewea.org/publications/reports/wind-energy-electricity-prices/

HighRES scenario

TABLE 3 FOSSIL FUEL INPUTS FOR POWER GENERATION AND WIND GENERATION, HighRES SCENARIO

Fuel input for thermal generation (Ktoe)	2012*	2015	2020	2025	2030	Change in % (2012/2030)
Solids	208,905	209,783	153,229	116,717	53,950	-74%
Oil	15,595	14,589	8,560	10,199	9,028	-42%
Gas	145,869	141,081	124,787	126,024	110,577	-24%
Total	410,954	424,609	371,495	346,950	280,705	-32%

TABLE 4 WIND GENERATION

Wind generation	2012*	2015	2020	2025	2030
GWh	230,810	331,048	613,064	784,618	1,198,239

TABLE 5 FUEL COSTS

Total fuel costs	2012*	2015	2020	2025	2030
Solids	24,347	26,646	21,067	17,137	8,425
Oil	8,343	6,991	3,625	4,747	4,580
Gas	45,902	43,186	37,129	41,871	40,576
Total	78,592	76,823	61,821	63,755	53,582

Sources: European Commission (2011)
(*) EWEA (2011)

CPI scenario

TABLE 6 FOSSIL FUEL INPUTS FOR THERMAL GENERATION AND WIND GENERATION, CPI SCENARIO

Fuel input for thermal generation (Ktoe)	2012*	2015	2020	2025	2030	Change in % (2012/2030)
Solids	208,913	212,061	172,763	167,428	136,756	-35%
Oil	15,695	15,188	8,979	12,402	12,388	-21%
Gas	145,390	142,400	125,116	122,606	120,044	-17%
Total	410,755	427,883	389,444	392,044	361,342	-12%

TABLE 7 WIND GENERATION

Wind generation	2012*	2015	2020	2025	2030
GWh	230,810	313,661	539,318	633,591	807,355

TABLE 8 FUEL COSTS

Total fuel costs	2012*	2015	2020	2025	2030
Solids	24,347	32,320	32,525	34,088	29,939
Oil	8,343	8,872	5,686	8,362	8,860
Gas	45,902	51,568	51,246	54,917	58,370
Total	78,592	92,759	89,458	97,366	97,169

Sources: European Commission (2011)
(*) EWEA (2011)

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[8] **The European Commision "Impact assessment for a 2030 climate and energy policy framework" (2013)**

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EWEA is the voice of the wind industry, actively promoting wind power in Europe and worldwide. It has over 600 members from almost 60 countries, including wind turbine manufacturers with a leading share of the world wind power market, plus component suppliers, research institutes, national wind and renewables associations, developers, contractors, electricity providers, finance and insurance companies, and consultants. This combined strength makes EWEA the world's largest and most powerful wind energy network.

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