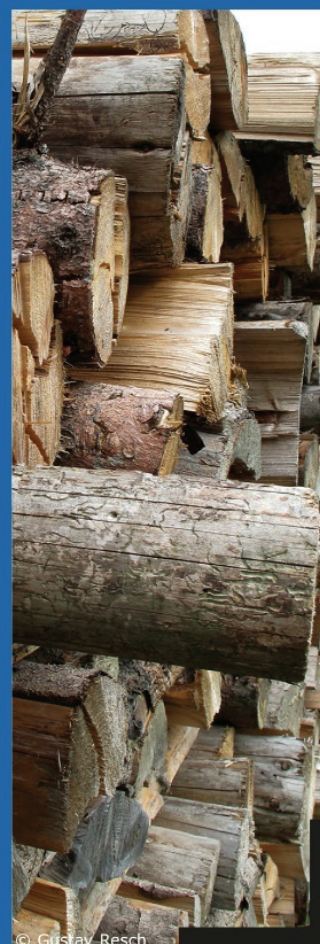
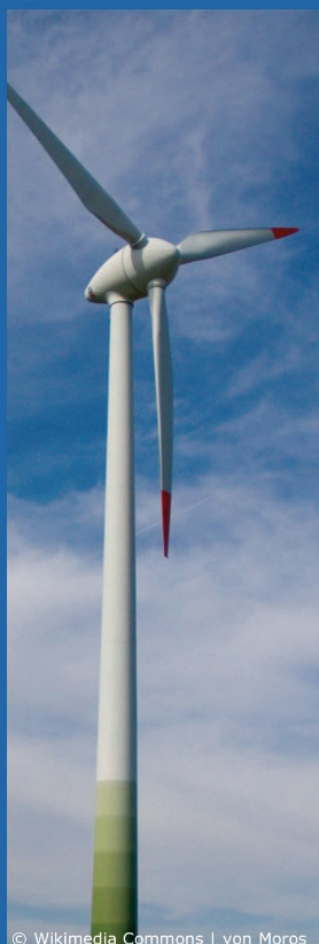


Renewable Energies *versus* Nuclear Power

Comparing Financial Support



Summary

Imprint

Authors

Austrian Institute of Ecology

Mag^a. Gabriele Mraz, MA

Mag^a. Andrea Wallner (concept)

e-think

DI Dr. Gustav Resch

DI Dr. Demet Suna

Translation

Mag^a. Patricia Lorenz

Study commissioned by

Wiener Umweltschutz / Vienna Ombuds-Office for Environmental Protection

Download

http://www.ecology.at/wua_erneuerbarevskernenergie.htm

Vienna, November 2014

Foreword

Discussion about nuclear energy has changed a lot during the last decade. In the last century the focus was mainly concentrated on safety issues. With the dawning of the renewable energies the focus in the whole energy sector shifted to costs. Today the cost structure of renewable energies is well understood and known. As predicted for emerging technologies costs are decreasing with the time. The real costs of nuclear energy as well as for fossil electricity production are not well known as these technologies stem from a time when states made decisions not mainly driven by economical reasoning.

First new building projects in the nuclear sector in Europe after the liberalisation of the electricity market give a first impression of the real costs of new nuclear. What started with the calculation of the external costs of a running nuclear plant can now be amended with the costs for new power reactors. This paper is simply about the question: "How much electricity can we get out of different energy sources on the current market for a given sum of money".

The Vienna Ombuds-Office for Environmental Protection hopes to provide with this paper a strong basis for the discussion of the future of nuclear power. The paper is aimed to close a gap in our knowledge to make a well based decision. This paper is to be seen in a series of papers financed by the Vienna Ombuds-Office for Environmental Protection dealing with environmental as well as with economical questions in the field of nuclear power generation.

Andrea Schnattinger, Ph.D.

Head of the Ombuds-Office for Environmental Protection

Summary

The European Union is divided on the issue of electricity production. While there is consensus that generation technologies need to be low on greenhouse gas- emissions, the question of whether to use renewables or nuclear to meet this power demand is highly controversial. Both options still require financial support and this is not going to change in the near future. This raises the question of where our money should be invested in order to achieve greater economic efficiency: into support for renewable energies (RE) or support for nuclear power plants?

This paper sets out to answer this question. The detailed model-based prospective scenario assessment performed in this study provides the basis for estimating future cost developments. After discussing the existing support schemes for renewables, the paper compares these with a nuclear model. The recent state aid case for the construction of the nuclear power plant Hinkley Point in United Kingdom serves as the model for the nuclear option.

New milestone in nuclear state aid: Hinkley Point

It is planned to construct two additional reactors at Hinkley Point. The EU estimates the total capital needed for construction at € 43 billion. The UK government intends to grant state aid for this project; in accordance with EU state aid rules, the suggested state aid scheme was submitted to the EU Commission for approval as public funds would be used for a company. A central part of the state aid scheme is the Contract for Difference which runs for 35 years. According to this contract, the state commits to compensating any difference between the electricity market price (reference price) and the negotiated Strike Price. Consequently, the plant operator, NNB Generation Company Limited (NNBG), has received a **long term price guarantee** which, in principle, is analogous to the feed-in tariffs commonly used to support renewable energies. The Strike Price for the first unit to be constructed has been set at € 108 per MWh (with each subsequent unit receiving € 104 per MWh), plus an index adjustment. Calculated over 35 years, the duration of the Contract for Difference, this adds up to a Strike Price in 2058 of approximately € 329 per MWh (in nominal terms). On top of this, NNBG will be granted a state loan guarantee for all loans the company takes out on the financial markets to construct the nuclear power plant.

After revising the state aid scheme, this contract was declared compatible with EU regulations and approved in October 2014. This decision is highly controversial within the EU. It led Austria to announce that nuclear power should be excluded from state subsidies.

EU support for renewable energies

While building nuclear power plants is increasingly facing problems with public acceptance, construction cost overruns and the non-existence of final repositories, over the past years renewable energies have been gaining ground. National policies for supporting renewables have been established in accordance with relevant regulations at EU level, such as the directive 2009/28/EC.

Analogous to the planned support for nuclear power in UK, renewable energies usually receive support through feed-in tariffs¹. Quota systems with tradable green certificates are also common.

¹ Guaranteed remuneration (or tariff) for electricity fed into the public grid; usually the rate of remuneration does not correspond with the electricity market price.

Comparing costs of renewable and nuclear power generation

Method

Renewable energies were compared with the nuclear option by looking at the quantities of power they can both generate and the level of financial support this requires. This mirrors the extra costs which must be borne by the end consumer or society. Five different renewable technologies were analysed: biomass, onshore and offshore wind, small-scale hydropower plants and photovoltaics.

The static approach compares the current (as of 2013) level of incentives for renewables with the state support mechanism for Hinkley Point. The dynamic approach, in contrast, also considers additional factors including future cost reductions achieved through increasing technological experience and aspects of market integration of variable renewables like solar and wind power. The dynamic approach has been calculated up to 2050; the nuclear option is added from 2023 onwards (planned start-up for Hinkley Point C). The dynamic calculation applies a detailed model-based analysis using the Green-X-model (www.green-x.at). This model takes into account a multitude of factors including costs, potentials, regulatory frameworks, diffusion constraints like non-cost barriers, electricity prices and energy demand, all of which have a strong impact on the economics of power generation.

Results

The static and dynamic calculations were conducted for five different EU Member states (United Kingdom, Poland, Germany, France and the Czech Republic) and the EU 28 overall. The countries were selected to reflect different starting points with regards to the current and potential use of nuclear power and renewable energies. First we provide an overview of the current status and foreseeable development of renewables and nuclear power in each country.

The **static approach** showed that, **in the five countries examined, under the same budgetary conditions it is almost always possible to generate more electricity from renewable sources than from nuclear power.**

Currently, among the assessed technologies small hydropower plants and onshore wind are the least expensive methods of generating electricity. With the help of public support (as the Polish example illustrates), the co-firing of biomass in fossil-fuel fired power plants is another method of generating electricity cost-effectively. Electricity production in offshore wind farms and photovoltaics, however, are the least economic options under current circumstances within the assessed countries (as of 2013). **Potential savings achieved by generating a set quantity of electricity from renewables rather than nuclear power range from 2% (Great Britain) to 63% (France) for onshore wind parks, and from 31% (Poland) to 51% (France) for small hydro power plants.**

The **dynamic approach** dares to take a broader look into the future. It calculates, amongst others, the future cost of generating electricity (€ per MWh) and the extra costs (i.e. support expenditures) which society and the end consumers must bear. Figure 1 illustrates the expected market value of the electricity supplied (broken line) and the remuneration required for renewables and for nuclear power (solid line) at EU level. The resulting differences are the costs which must be borne by the public.

The remuneration needed for renewables is less than for nuclear power. The expected market value of electricity generated by nuclear power is, however, greater than that of renewables, and this difference will continue to increase through to 2050.

While the UK's feed-in tariff for nuclear power is planned to remain constant, the deviation from the electricity market price will continuously decrease because the market price for electricity can be expected to rise; this also causes the originally high burden on the public to shrink over the decades.

For renewable energies, the average remuneration level first decreases strongly and later less so. The gap between market value and required remuneration will continue to decrease; the remaining difference will be mainly caused by offshore wind. Two conflicting trends have an impact on the necessary support for renewables. On the one hand, costs will fall due to technological learning (e.g. the falling costs of photovoltaics in Germany and worldwide), and on the other, the greater deployment of renewables leads to a decrease in their market value.

This is especially the case for wind energy and solar electricity, sources in which production is determined by natural supply and therefore cannot react flexibly to decreasing demand. Furthermore, the share of necessary financial support depends upon the particular characteristics of each country and technology.

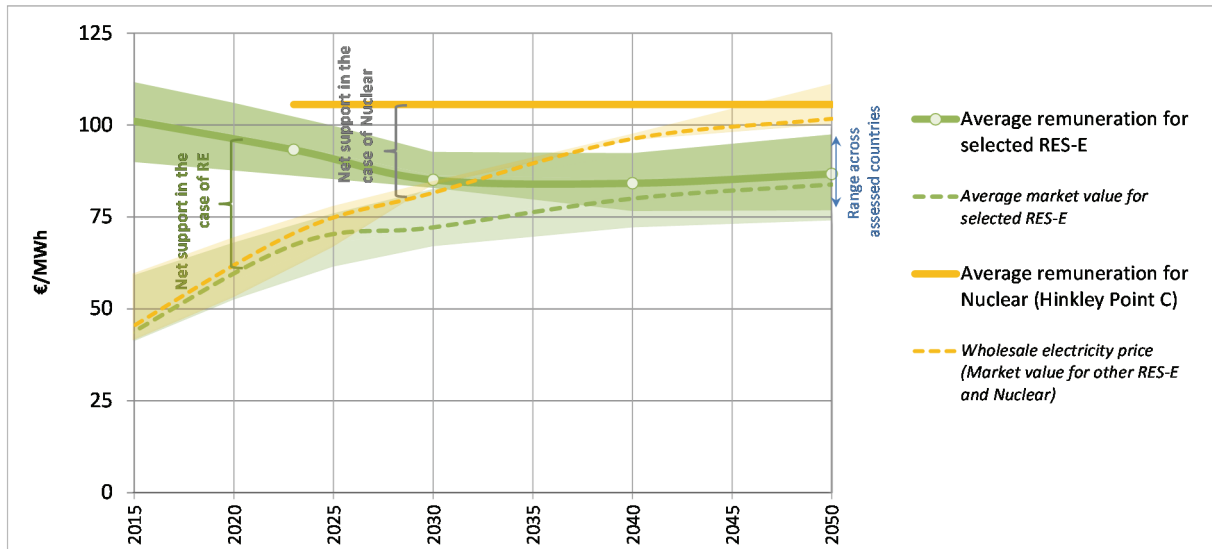


Figure Summary 1: Future development of remuneration levels and corresponding market values of the assessed RE technologies (as aggregate) and of nuclear power across assessed countries and at EU28 level according to the Green-X scenario of dedicated RE support (Source: Own assessment (Green-X))

The next step was to estimate the average costs which will arise for electricity consumers for the period 2023 to 2050. Figure Summary 2 shows the results.

For each of the countries analysed and for the EU as a whole (EU28), generating electricity using nuclear power requires more public support than renewables. The level of support required varies and mainly depends on the future electricity price; the future UK electricity price is predicted to be especially high.

Or expressed differently, as shown by Figure Summary 3, the analysed countries and the EU-28 could achieve the following % cost reductions through the increased use of renewables compared to nuclear power.

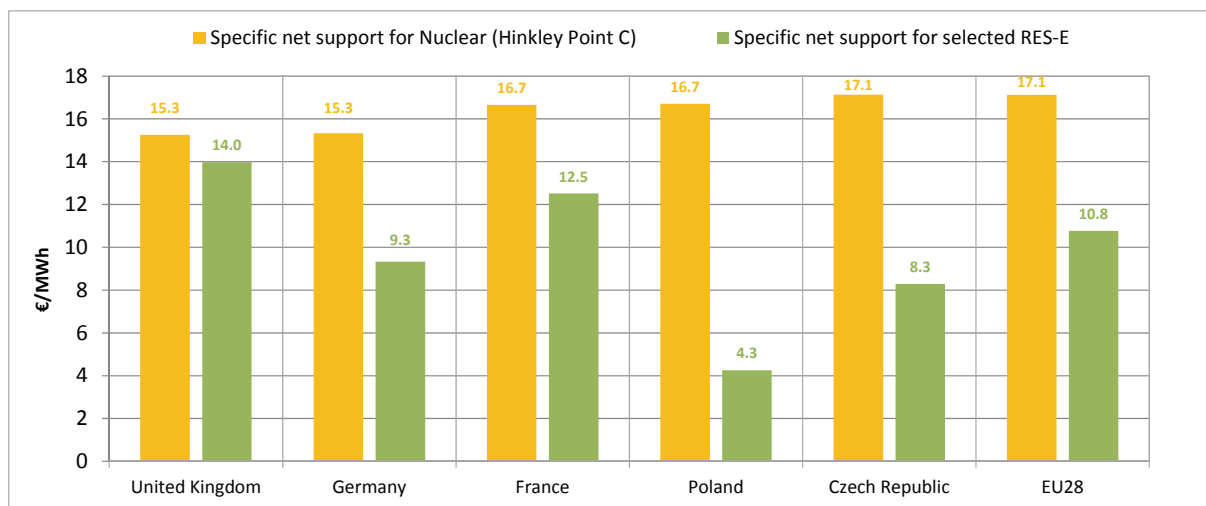


Figure Summary 2: Comparison of overall cost-effectiveness: Specific net support for assessed RE technologies and nuclear power by assessed countries and at EU28 level according to the Green-X scenario of dedicated RE support (Source: Own assessment (Green-X))

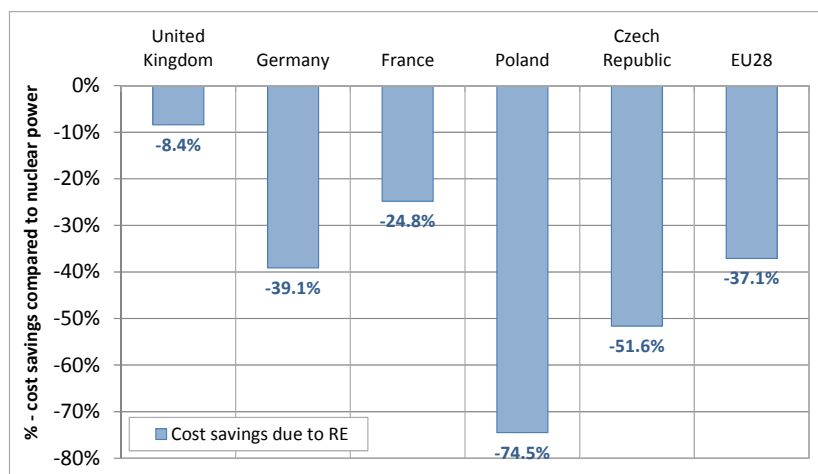


Figure Summary 3 Comparison of overall cost-effectiveness: Cost savings due to RE compared to nuclear power by assessed country and at EU28 level according to the Green-X scenario of dedicated RE support (Source: Own assessment (Green-X))

Conclusions

Generating electricity from a variety of renewable sources is more economical than using nuclear power; this is clearly shown by the model-based assessment of future developments up to 2050. Across the EU end consumers can save up to 37% on their electricity costs – in some Member States even up to 74% – when plans to build nuclear power plants are shelved in favour of renewables. In order to achieve these goals it is vital that we act quickly, but with care, to create the infrastructure and regulatory framework this requires, or to adapt that which already exists.

