

HOW THE TRANSFORMATIVE TREND IN ENERGY SYSTEMS IS SYSTEMATICALLY UNDERESTIMATED – AN ANALYSIS OF THE IEA WORLD ENERGY OUTLOOK 2017

For years the International Energy Agency has consistently underestimated the role of renewable energies, a fact which commentaries have repeatedly criticised. The current World Energy Outlook (WEO) also contains an overly reserved estimate for the future market development in renewables, at least in the case of photovoltaics. In our newest analysis of the 764-page report, Steffen Bukold (energycomment) and I describe the essential messages and some background information regarding the transition in the energy system and the WEO modelling. It shows not only that renewables have been underestimated, but conventional energies are being clearly overestimated. It is high time for a critical review of some basic assumptions applied to conventional energy scenarios.

The International Energy Agency's (IEA) World Energy Outlook (WEO) is among the most important international publications on global energy supply and is understood as an indicator for the development of energy supply and crucial trends. The 764-page report was presented in London on 14 November 2017. It offers a wide range of information, analyses and scenarios. The WEO's political role should not be underestimated but also its impact on investors working with IEA scenarios.

For years the International Energy Agency has been criticized for its future projections and key messages (see also Michael Liebreich's lecture at the 2017 Bloomberg New Energy Summit in London or German Manager-Magazin). This has particularly been the case for its consistent underestimation of renewable energy technologies over many years. Essentially this critique also applies to the World Energy Outlook 2017, but in our opinion it is far more than simply about technology-specific approaches. Three arguments are particularly important:

The future projections in the WEO (New Policies Scenario) are not treated as scenarios which explain the political scope for action as actually defined in the WEO. But they are presented as prognoses. The public discussion also reflects this.

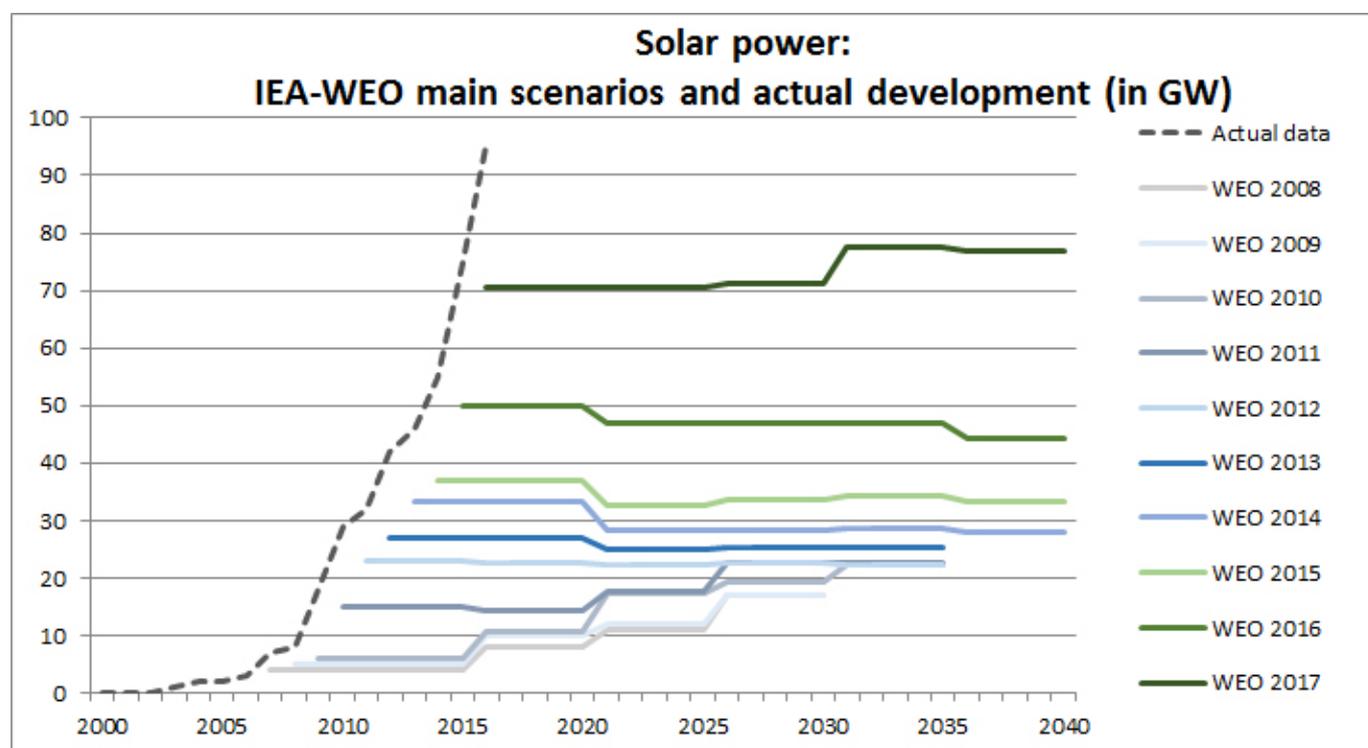
The long-term underestimation of renewable energy technologies and simultaneous overestimation of fossil technologies such as CCS (carbon capture & storage), as well as coal-fired electricity and nuclear power.

The World Energy Model method applies a heavily demand-oriented approach and fails to question demand-stimulating factors such as global GDP.

The breakthrough of solar power

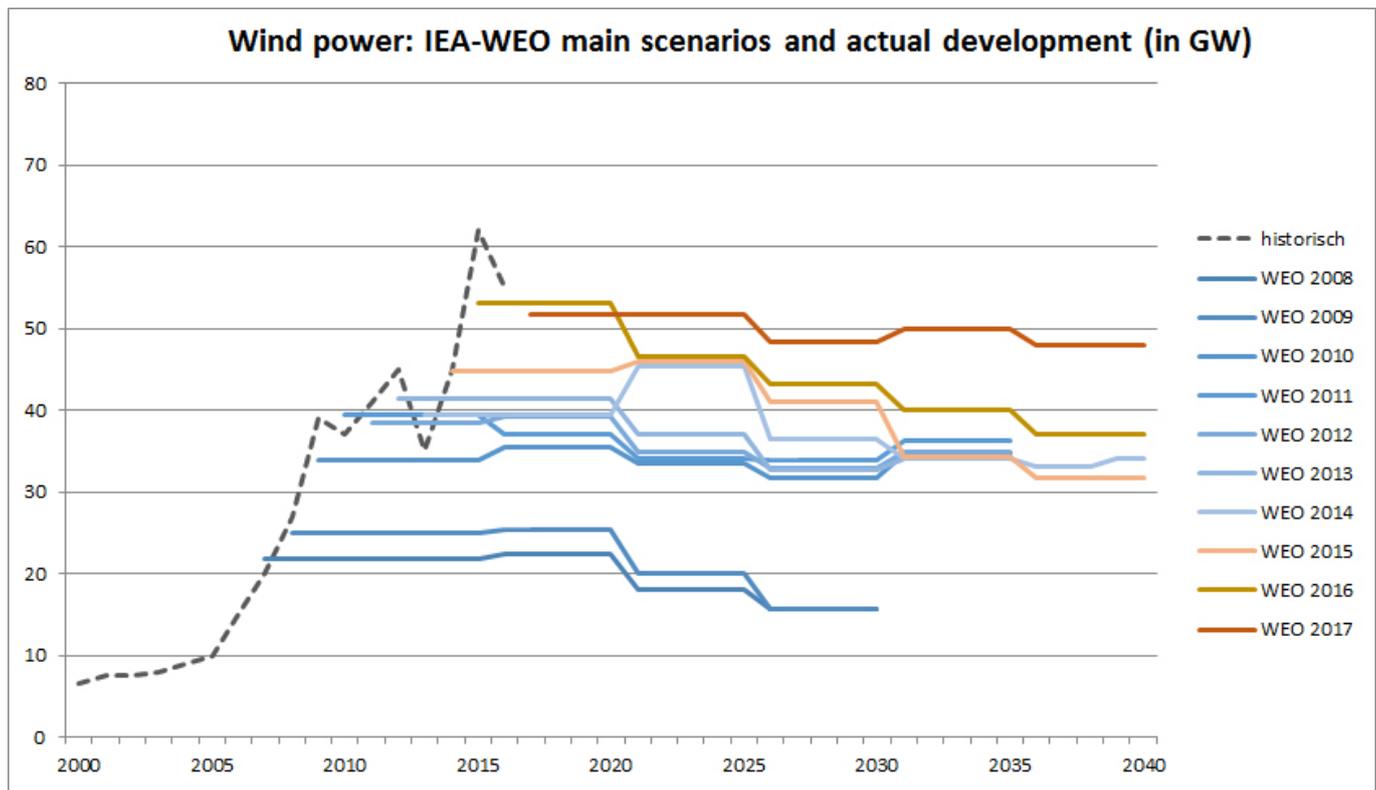
Looking back over several years of past WEO estimates for the development of photovoltaics not only shows that the prognosis was raised in almost each

issue, but also that the **actual data were always above the IEA projections.** For the **WEO 2017**, a **systematic underestimation again seems likely.** While the WEO 2017 tables assume new annual deployment of nearly 70 GW over the coming years, the first preliminary market analyses indicate approximately 95 GW of additional photovoltaic installations for 2017 alone. The cost development also makes a decline in additional deployment over the next years highly unlikely. The IEA argues that in the main scenario they could only consider the plans and intentions of political actors, e.g. Beijing's photovoltaic deployment goals, which are continually revised upwards. The analysis clearly showed that the **IEA continued to forecast a stable deployment of photovoltaics, with the result that they were significantly wrong each year,** and underrated the dramatic increase in growth rates. Certainly, forecasts can be wrong, but here the error appears to be systematic. **Over the past years photovoltaic capacities have increased more strongly than any other type of electricity generation,** whilst since 2010 the costs of new photovoltaic systems have fallen by 70%, according to the IEA's own data.



Wind power: adjusted forecasts

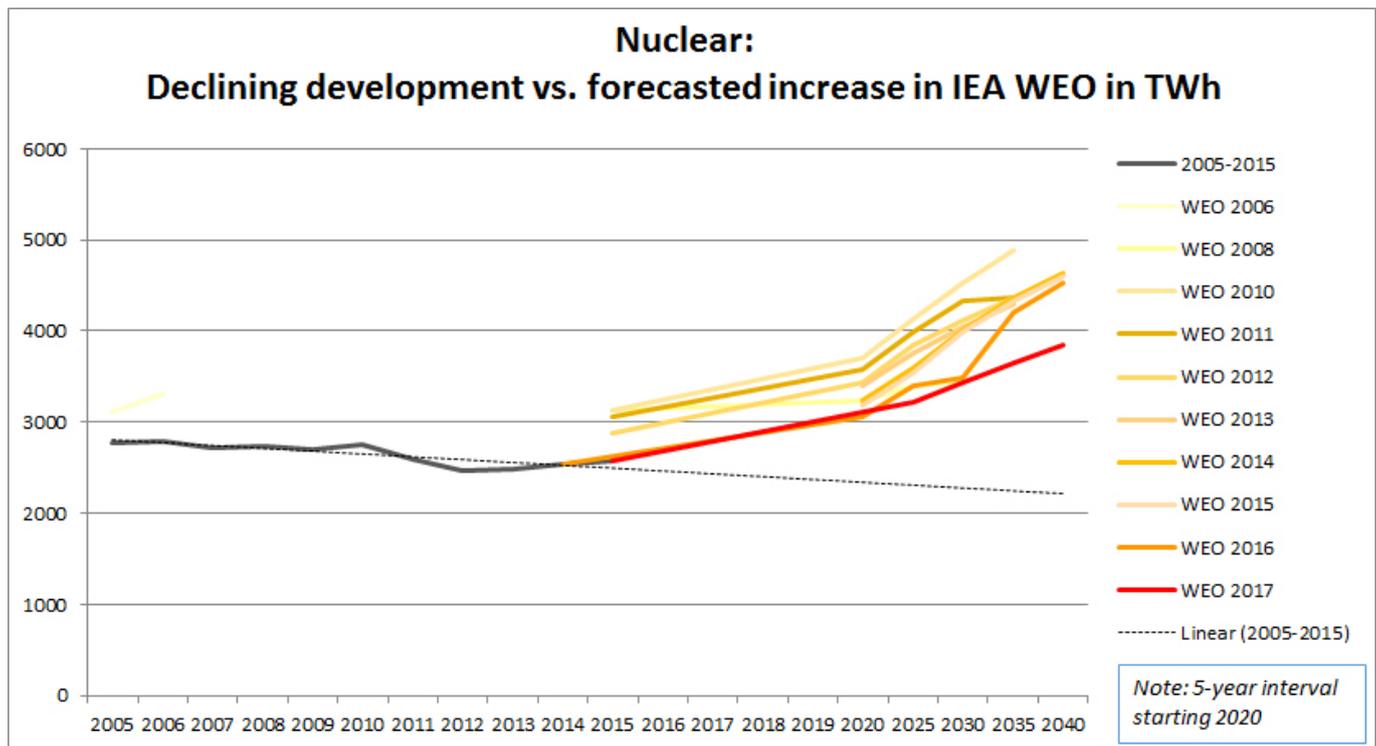
The WEO 2017 also presented adjusted forecasts for wind power. The long-term development was re-assessed, although without raising the annual deployment level. Instead of forecasting a decline in the annual added capacity, as past WEO issues regularly did, capacity is now expected to grow by an average of 50 GW each year. Looking back at past developments, we observe that the wind power development was more volatile than photovoltaics' development.



Example: incorrect nuclear power prognoses

Incorrect prognoses were made not only for renewables but also for conventional power generation – in its favour. Exactly ten years before the current issue the World Energy Outlook 2007, the reference scenario for the production of nuclear power, published forecasts of 3,083 terawatt hours for the year 2015; similar figures were suggested in the WEO 2006 (3,108 TWh) and slightly higher ones in the WEO 2008 (3,134 TWh).

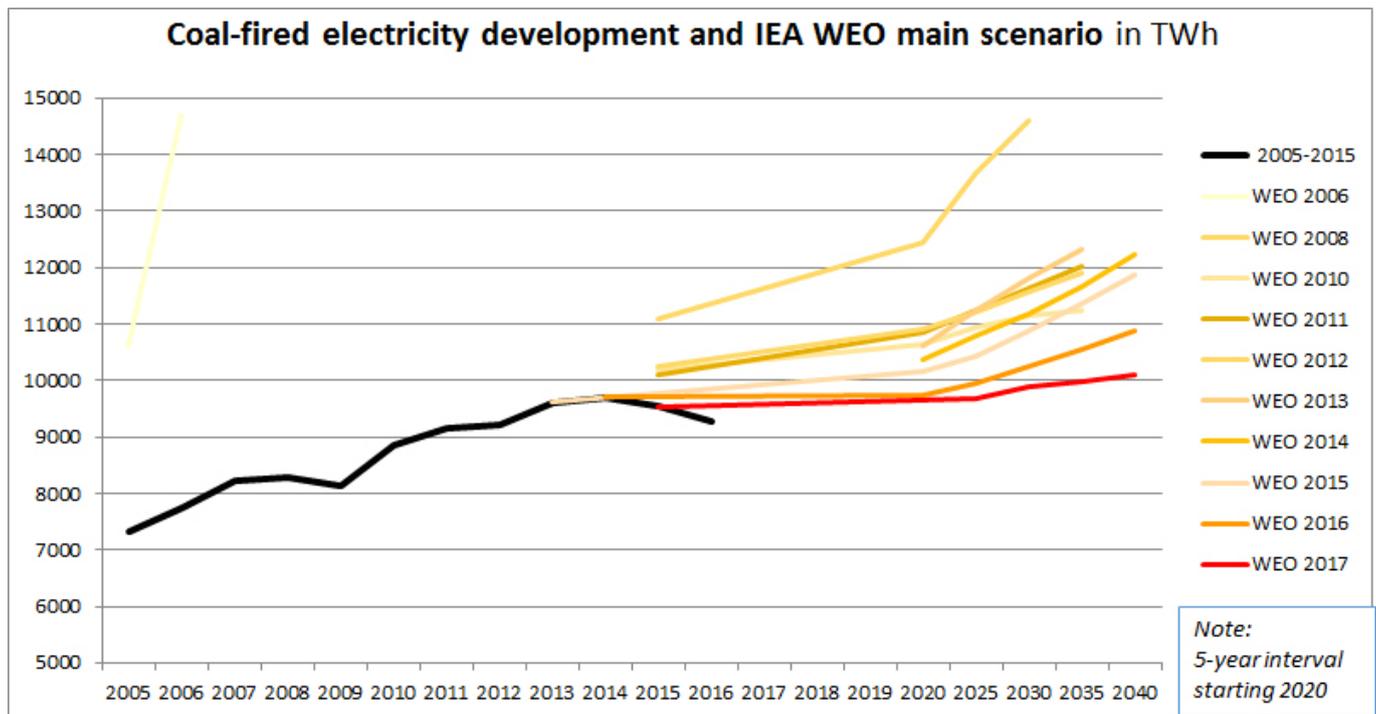
However, the WEO 2017 stated how much nuclear electricity had actually been generated in 2015: 2,571 TWh. **Thus the forecast had been more than 500 TWh, or one fifth, higher than the value generated.** In principle, it can be argued that ten years ago certain developments could not be foreseen, including the nuclear disaster at Fukushima (2011) or Germany's partial nuclear phase-out. But it also shows that the models fail to consider larger disruptions, because the costs and the risks associated with the construction of new nuclear power plants allow marketability only where there is backing from the state in the role of operator or financier. Even so, this is not a guarantee that the plant will be implemented.



It is remarkable that the WEO 2017 prognosis for 2030 still expects higher nuclear power values than those forecast ten years ago for 2030, at 3,440 TWh (WEO 2017) compared to 3,275 TWh (WEO 2007). These future predictions clearly contradict the trend of the past ten years. Nobody seems to query this forecast, even though the development of the forecasts in the main WEO scenarios show significant differences.

Incorrect prognoses for coal-fired electricity

Even more striking is the **incorrect prognosis for coal-fired electricity**. Ten years ago (WEO 2007) the IEA forecast that coal-fired electricity would reach 11,081 TWh in 2015. In spite of the uncontested coal boom and enormous growth taking place in China, for example, the real values for 2015 only reached 9,532 TWh—1,500 TWh below the forecast. The forecast for 2030 has now been significantly downgraded (9,880 TWh in the WEO 2017 rather than the 15,796 TWh expected for 2030 in WEO 2007), however there are many reasons to question the actual growth in coal-fired electricity through to 2030.



Interesting in this context is Jonathan Moylan's article on the World Energy Outlook's "Coal Bias", See: <https://independentaustralia.net/environment/environment-display/the-ieas-world-energy-outlook-and-its-coal-bias,11132>

Method – about the World Energy Model

Since 1993 the World Energy Outlook's scenarios have been calculated using the IEA's own simulation model, the **World Energy Model (WEM)**. The WEM is a partial equilibrium model for the global energy market; certain external variables are accepted as independent and given. A differentiated energy market model calculates the **development in regional energy demand** on this basis. Using an iterative process, the next step models the adequate energy supply and the equilibrium prices. It is important to understand that the **IEA's price assumptions are determined in an idealized market** and therefore **represent the minimum prices necessary to trigger the investments needed to satisfy demand**. Price interventions conducted by cartels or caused by continuous underinvestment are not taken into account; nor are innovation leaps or unexpected leaps in cost.

An assumption is also made for **CO₂ prices**: For the EU a CO₂ price of 25 \$/t (approx. 21 €/t) was forecast through to 2025, and for China 17 \$/t. In the main scenario these emission prices increase to 48 \$/t for the EU and 35 \$/t for China by 2040; this is far too little to achieve the Paris Climate Goals.

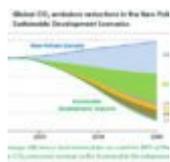
The third external input is the **policy programmes** of the individual states. For the main scenario (New Policies Scenario), Annex B of the report lists the measures and programmes which, according to the declarations of intention by individual regions and states, will be realized. Many uncertain variables exist here, including the future development of climate goals, political changes (see U.S., but also China) and the overall political dynamics – protectionist measures being amongst them.

Clearly, this model has not sufficiently described significant leaps in technology and market developments. It is also clear that the transformation in energy supply requires a new approach in the overall system of which a demand-oriented, sector-specific view is only a part, and a holistic approach of an increasingly sector-coupled, integrated energy system is gaining importance.

Good news for everyone – bad news for all of us

A look into the WEO main scenario (New Policies Scenario) shows that, despite all the shifts, in the end all industries expect one thing: continued growth. In addition to the applied methods, a reason for this seems to be political. In the end, every energy sector can use the IEA prognosis to signal to the market and investors: “Look! We will continue to grow.” Even the coal industry which has recently experienced strong setbacks. The nuclear industry, too, uses the WEO for its marketing purposes, as of course energy efficiency services and renewable energies, and oil and gas can do. **However, it is more than questionable whether growth is possible in all sectors. From the perspective of fulfilling the Paris Agreement, the answer is clearly NO.**

Paris Agreement: we’re not on track



But the IEA World Energy Outlook has another key message. With its three scenarios (including a Sustainable Development Scenario) it is obvious that global energy supply is far away from being in line with the targets of the Paris Agreement. The focus on the main scenario (New Policies Scenario) in the WEO communication has a doubtful perspective on market development (see above) but it also makes clear that without policy instruments and measures (e.g. carbon pricing, regulatory measures etc.) the transition of energy supply happens far too slow. Especially when having a look at heating (industry) and transportation the Energiewende will not come automatically but needs more efforts on political level.

The analysis of IEA World Energy Outlook by Georg Günsberg and Steffen Bukold—commissioned by the Federal Ministry of Sustainability and Tourism—is available in German and can be found here: http://guensberg.at/wp-content/uploads/2018/03/Analyse-WE02017_Jänner2018.pdf