What can be expected from COP21 from the viewpoint of clean technologies?

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The new bottom-up approach invites individual countries to propose national emission reduction targets on a voluntary basis. These statements had been due to end of May 2015. As far as it is known today, most national emission reduction targets are not rather ambitious. It therefore seems that the IPCC target of limiting the global temperature increase by 2 degrees Celsius will probably not reached. Many nongovernmental organizations and climate scientists conclude that such an outcome of the COP21-Conference will be a failure if the international community of states will not reach an agreement with more significant emission reductions. Also the perception in the media would be rather negative.

But for me it would be a great success if a larger number of countries, developed as well as developing, engage in more or less binding political commitments in favor of reducing greenhouse gases. The key outcome of an COP21-agreement should be a strong global commitment to push innovative technologies and markets for energy efficient products and buildings, alternative propulsion systems and, most important, power generation from renewable sources. The development of such technologies and markets doesn’t depend on quantitative emission reduction targets that are determined in an international treaty. It is also not important if some major country is not yet “on board”. Crucial is that countries committed to implement instruments that will reduce their domestic emissions through supporting appropriate innovations, technologies and markets. Thereby a focus should be on solutions that have the potential to soon become competitive against the polluting technologies presently in use.

In the German energy transformation it can be observed how such an emission reduction strategy may work. In 1999 the German government had introduced generous fixed feed-in premiums in order to replace nuclear and fossil power generation by renewable capacities, in particular onshore wind, offshore wind and photovoltaics. As a consequence of this decision, the German renewable electricity share grew from 5 percent in 1999 to more than 27 percent in 2014. The government intends to expand the share to 35 percent until 2020 and to more than 50 percent after 2030 and it seems quite likely that these numbers will be reached. But there is a price for it: electricity consumers in Germany have to pay for the difference between renewable electricity costs and their market value. In 2015 alone this difference is about 20 billion Euros. Still these payments are socially accepted, and therefore the market entry and diffusion of advanced renewable generation technologies became possible and is likely to continue.

In addition to greenhouse gas reductions, there are important economic benefits associated with this development (see “Statement on the first progress report by the German government for 2013”, presented by the Expert Commission ’Energy of the future’ monitoring process; www.bmwi.de/English/Redaktion/Pdf/monitoringbericht-energie-der-zukunft-stellungnahme-zusammenfassung-2013.pdf). Taking the example of photovoltaics, the unit investment costs declined to 2000 Euros per kilowatt installed capacity. In 2012 the photovoltaic capacity outside Germany reached 70 Gigawatt, while in Germany it exceeded 35 Gigawatt. In order to quantify the economic benefit, one may assume for simplicity that the capacity outside Ger-
many would be independent from the German renewable support scheme. Without the German photovoltaic investments the photovoltaic unit investment costs would then be 2600 instead of 2000 Euros per kilowatt, assuming a learning rate of 15 percent. This cost advantage can be attributed to the German support for photovoltaic electricity. To calculate its global impact, one has to multiply the cost difference with the global annual photovoltaic investments. The result is more than 40 billion Euros in 2012. This is twice as much as the annual incremental payments of German consumers for renewable energy. Today photovoltaic electricity contributes a rather small share of power generation as it is not yet competitive outside certain market niches, but on a global scale the German renewable electricity support generates a global financial return that largely exceeds the national expenditures.

On a short term scale, most of these benefits occur outside Germany. But in the long term perspective, some benefits will flow back to the German society: Global greenhouse gas reductions become easier and cheaper. German investors benefit from learning effects initialized by photovoltaic investments outside Germany and, most importantly, the world becomes a better place offering opportunities for income and trade.

Coming back to the expectations from COP21, it is important to repeat that this positive innovation outcome is not primarily the result of the quantitative reduction targets for domestic, European or global greenhouse gas emissions. The key for success is the strong commitment of governments, the industry and the societies to develop and apply clean technologies. For this purpose a reliable support scheme needs to be in place.

But there is another lesson from the German energy transformation: Low-carbon energy solutions cannot come from a short list of some few innovative technologies alone. Crucial is a network of innovation activities that all may directly or indirectly help to reduce emissions. Particularly important are innovations towards the system integration of low-carbon technologies. Taking again the example of photovoltaics, this technology becomes more and more attractive once its specific investment costs further decline. Therefore the number and sizes of market niches are growing in which photovoltaic power generation becomes competitive. However, photovoltaics alone cannot solve the carbon emissions problem associated with electricity generation because this technology cannot supply electricity whenever it is needed. Other innovative solutions such as batteries, load management, smart grids, smart meters, intelligent charging, power-to-gas technologies and so forth are required for transforming photovoltaics into a reliable electricity supply system.

There are a lot of ideas and prototype technologies around. But as surprises and disappointments appear to be inevitable, picking the winners through current political decisions is not rather promising. A lot of real market experiments are needed and a multitude of concepts should be tested in order to finally achieve at an acceptable solution. Redundant and perhaps duplicating research and development efforts are likewise inevitable.

The existing electricity markets with large shares of intermittent renewable power sources are not only a driver for these experiments but also an excellent test environment. With the growing share of non-dispatchable electricity generation the potential actors and the manifold of experiments, the search space, is likely to become larger. This increases the chances for effective and efficient solutions. Governments should restraint in hasty and selective market interventions that derogate the search space. They should also allow time for system integration concepts to become mature.
According to my view the COP21-negotiations should focus on these topics. It seems to be feasibly that significant conclusions along these lines can unanimously be decided. As a consequence, COP21 can be regarded as a success, even if it remains still unclear how the global temperature increase in the current century can be limited to 2 degree Celsius.