

The urgent need for rapid transition to 100% renewable energy

Hans-Josef Fell

Energy Watch Group Berlin, Französische Straße 20, 10117 Berlin, Germany

ABSTRACT A transition to a global 100% renewable energy system is no longer a matter of technical feasibility or economic viability, but one of political will. Not only do we need ambitious targets, but also stable, long-term, and reliable policy frameworks, adapted to regional conditions and environments. This research does not only add one more study about climate-benign future energy systems, but rigorously opens up a new perspective towards a shift to 100% renewable energy within the next two to three decades. It features a cost-efficient vision of a deep electrification of the heat and transport sectors around the globe based on a detailed assessment of spatially highly resolved renewable energy potentials that are domestically available in hourly resolution of a full year. The outlined global transition pathway stands out as the first to present a 1.5°C scenario that is technology-rich, multi-sectoral, multi-regional and cost-optimal. Notably, it achieves a cost decline without the reliance on high-risk technologies such as nuclear power and carbon capture and sequestration (CCS). A full energy transition to 100% renewable energy is not only feasible, but also cheaper than the current global energy system. We call on the global community to urgently pursue a forward-looking pathway towards net zero ghg emissions by launching a rapid change of the way we use natural resources and provide electricity, heat and transport

I. INTRODUCTION

The global challenges for humanity to live together in prosperity are getting bigger and appear increasingly insurmountable. War, terror, poverty, refugees, degradation of entire habitats, particularly due to global warming, are increasing in number rather than declining. The cause is often the unjust world economy, which mainly relies on the use of fossil and nuclear raw materials.

The complete replacement of the conventional energy system with emission-free or CO₂-neutral renewable energy is at the heart of a successful strategy to address these major challenges of humanity. In addition to an emission-free economy, a sustainable global economy requires an economic development path, which can further reduce high carbon concentrations of today 420ppm CO₂ in the atmosphere at a grand scale, to a level not exceeding 350 ppm.

The 100% renewable energies including a strong expansion of photovoltaics are the indispensable core of such a climate protection strategy.

Various scientific studies show that the global community can be completely supplied with 100% renewable energy for

electricity, heat, transport and industry, anywhere in the world and every hour of the year.

Solar and wind energy together with battery storage to ensure a secure power supply all year round is the cheaper option today compared to coal, natural gas, oil and nuclear energy.

An energy system with 100% renewables can also be set up quickly and economically advantageously in Mongolia, given the endless areas available for solar and wind energy.

This would make a significant contribution to strengthening Mongolia's economy and reducing the harmful air pollution in Ulaanbaatar.

Mongolia's neighbor China is today leading the world community in the development of clean technologies: Solar, batteries, e-mobility and others. Mongolia can collaborate with China to become a role model for the global community for successful climate protection, clean and healthy economy.

II. 100% RENEWABLE ENERGY WORLDWIDE IS FEASIBLE AND COST-EFFECTIVE

A global energy transition to 100% renewable electricity is no longer a question of technical feasibility or economic viability, but of political will, a new study by the Energy Watch Group (EWG) and Lappeenranta University of Technology (LUT) has proved.

The study "Global Energy System based on 100% Renewable Energy – Power Sector"¹ published in November 2017 ultimately refutes a frequently used argument by critics, having proved that a global electricity system fully based on renewable energy is feasible at every hour throughout the year and is more cost effective than the existing system, which is largely based on fossil fuels and nuclear energy.

According to the study, a total levelised cost of electricity (LCOE) on a global average for 100% renewable electricity in 2050 would be €52/MWh (including curtailment, storage and some grid costs), compared to €70/MWh in 2015. A transition to 100% renewables would bring greenhouse gas emissions in the electricity sector down to ZERO and drastically reduce total losses in power generation. It would create 36 million jobs by 2050, 17 million more than in today's energy system.

III. 100% FAVORABLE POLICY FRAMEWORK IS DECISIVE TO ACHIEVE 100% RENEWABLES

In order to achieve a global transition to 100% renewable energy, the global community must significantly accelerate the process by adopting and implementing favourable political frameworks and measures. The following list presents the key policy measures required for a swift transition.

3.1. Adopting climate protection in national constitutions

The dramatic increase of world temperature is one of the most serious and urgent threats to humanity and human lives. As a political outcome of the Paris Agreement targets, climate protection must be adopted as a national target in constitutions worldwide.

3.2. Setting the political target for 100% Renewables by 2030

Policy makers on national as well as on the district and local levels have put forward the bold goal of switching the full energy supply to 100% renewable energy. All nations worldwide should follow the example of the Climate Vulnerable Forum – a coalition of 48 countries, most vulnerable to climate change. These countries have set a target and agreed on a transition plan on 100% renewable energy by latest 2050.

Communities and cities around the world need to contribute towards 100% renewables like hundreds of cities, which already did, including Vancouver, San Francisco, Munich, Frankfurt, Barcelona, Geneva, Doha and Sydney.

The willingness of the public to switch to 100% renewable energy is the first decisive step. The second step is a clear legislative framework to promote fast and steady growth of renewables. Two strategies are key to achieve such transition: on the one hand support for a fast growth of renewables is needed and on the other hand restrictions for all fossil- and nuclear corporations should be introduced.

To achieve a successful policy implementation with the goal to run on 100% renewable energy, national legislative acts are needed. Those have to be meticulously assessed, ensuring a high certainty in promoting the expansion of renewable energies.

The following policy measures and instruments have already proved to ensure a sufficient flow of private investments to renewable energy. Public funding is helpful and important but it should be complemented and topped by private investment since the transition towards renewable energy is a cost intensive matter. The required capital for a successful energy transition exceeds the potential of public budgets. The following measures describe the importance of each economically supporting tool.

IV. INSTRUMENTS, ENABLING DIRECT PRIVATE INVESTMENTS IN RENEWABLE ENERGY AND ZEROEMISSION TECHNOLOGIES

4.1. The German Renewable Energy Sources Act (EEG) is the prime example for a successful policy framework. It contributed largely to dramatic cost decreases for initially cost intensive technologies. Due to continuous cost reduction over the past years, wind and solar power have become mainstream renewable energy sources worldwide. The EEG with its feed-in-tariff and guarantees for renewables has proven itself a valuable tool.

Key points for an effective Renewable Energy Act (Feed-in Law):

- Privileged grid access for renewable energy sources
- Feed-in-tariff has to be appropriate for economic operation, with variations depending on technology and size
- Funding of feed-in tariff via electricity rate
- No cap for feed-in of renewable energies
- Degression of feed-in tariff with cost reduction of renewable technology investment
- Guaranteed period of remuneration

Recently a range of countries have drafted and adopted legal acts on renewable energy auctions and tendering. But a recent comprehensive policy brief² by Hans-Josef Fell and the Energy Watch Group for the International Renewable Energy Agency (IRENA) has shown that tendering procedures hinder the growth of renewables and result in higher prices for customers.

Furthermore, tendering procedures limit investments to large companies and exclude investment from decentralized actors, such as cooperatives. Tendering procedures should therefore only apply for capacities above 40MW, whereas remuneration by fixed feed in tariffs must be available for all projects with an installed capacity below 40MW.

We also need new innovative political measures, advancing with the tasks ahead, such as investments in network integration, interconnecting sectors and compensating fluctuations in wind and solar energy. A reformed version of a feed-in-tariff law offers precisely this: hybrid renewable power plant remuneration.

Such remuneration by fixed feed in tariffs would cover the plants with different mixes of renewable energy technologies and would ensure the grid stability during the solar and wind energy fluctuations.

4.2. Removal of all state subsidies regarding energy generation with CO₂- and radioactivity emission

Accelerating the growth of renewable energies requires the abolishment of all subsidies for conventional fossil and nuclear energy plants and infrastructure. This includes especially subsidies for coal powered energy plants and new natural gas pipelines. Tax exemptions for fossil fueled power plants and fossil fuel use need to be ceased too.

4.3. Tax exemptions for investments in renewable energies

While tax exemptions for fossil and nuclear energy use need to be removed, tax exemptions for renewable energy sources need to be introduced. Companies and investors who contribute to making renewable energy technologies more efficient should be awarded with the incentive to receive tax exemptions. Companies who trade renewable energy should also receive these incentives to provide them with appeals to invest more money in renewables, which in the end maximizes the overall return on investment.

4.4. Pollution (CO₂ and Radioactivity) Tax

The general idea behind the pollution tax is to sanction energy companies which rely on fossil fuel and nuclear as generating resource, impairing the economic sector of the fossil/nuclear fuel economy. A sufficient pollution tax is able to promote renewable energy only if the prices for fossil/nuclear energy plus the tax exceed the average price in comparison to renewable energy prices. It does not promote renewable energy measure unlike the feed-in-tariff law but can, to a certain extent, impair conditions for fossil fuel energy plants with high emission levels. A pollution tax should therefore be closely connected with fluctuating energy prices and needs to be assessed meticulously.

4.5. Replacement of emission trading system with carbon and radioactivity taxes

The emission trading system did not prove to be an effective economic instrument in fighting climate change. Trade certificates are as a rule influenced by different factors on the economic market. It could occur that the prices for these certificates are decreasing to the extent that emission certificates would not perform the desired result in preserving climate conditions. Therefore the emission trading system is insufficient and should be disestablished, whereas a continuously rising CO₂ tax needs to be implemented.

4.6. Promoting research and education in the sphere of renewable energy and zero emission technologies

National support for research and science on renewable energy and clean technology is vital. The national budgets for research and education on renewables must be increased significantly, while financial support for fossil and nuclear development needs to be ceased. This would highly increase the share of financial means for renewables. The financial support for development and deployment should include technical development, analysis of the economical possibilities, the impact of renewable technologies, social and

cultural consequences as well as its impact on gender and acceptance.

Education as well as vocational training on all educational levels (kindergarden, schools, universities, further education) needs to be significantly improved. This is not only applicable in the technical field but also for economical tasks and accompanied framework programs. Awareness programs for the broad society on the dangers of climate change and the role of renewable energies as the most important solution need to be implemented.

4.7. Facilitation of authorization

Authorities and lawmakers must give assistance in authorization of construction sites to build renewable energy power plants and other renewable investment. This includes the required infrastructure such as storage and grid connection. These legal regulations must serve the cause to protect residents from greenhouse gas emissions and other dangers to health (noise, fumes from biogas, and others) as well as fulfill ecologic and social standards. Waste disposal, reduction of emissions, technical norms and local environmental protection should be considered too.

Protection of landscape, local bird and fish population need to be achieved through technical requirements and must not hinder investments in renewable energy.

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