

How Energy System Changes in a Low Carbon World

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Abstract: From hurricanes to sea level rise, the climate change has severely threatened human survival from many aspects, including food supplies, health, decent shelter, personal security, etc. This paper discusses energy system transitions when facing climate change and solutions worked out and will work out in the future.

Keywords: Climate Change; Energy System; Renewables; Climate Finance

1. Traditional energy sources change

Fossil fuels have become primary energy consumption resources since last century, while they are facing more challenges on production due to global need to decrease greenhouse gas emissions. How traditional energy system changes in a carbon-constrained world?

The answer depends on three main factors. Firstly, it depends on whether benefits from fossil fuels outweigh their resulting pollution. As driver of economic and social mobilization, fossil fuel exploitation contributes to affordable energy, job opportunities and export profits. However, its resulting emissions lead to global temperature increasing and more natural disasters. Secondly, energy efficiency matters when fossil fuels compete with renewables, such as wind and solar. Electricity generated from renewables enables to decarbonize economy during transition to low-emission energy system. It is extremely important to solve the problem that renewables are inflexible stored in quantities thus cannot match supply and demand well. For example, the output from wind and solar generators depends on the weather that beyond technical control. Thirdly, considering high variation in development conditions, many countries have to balance different energy resources and other priorities.

Recognizing the need to respond to climate crisis, 195 countries signed the Paris Agreement and considered their respective obligations on addressing climate change. New energy resources, policy interventions, and climate finance are urgently needed.

2. Upscaling sustainable energy resources

2.1 Integrating renewables with current policy framework

Integrating renewables into current policy framework means improving mechanism to change traditional policies into a resilient, low carbon-based system that makes best use of variable renewables while minimizing overall cost and enhancing security and reliability. As renewable technology costs continue to fall and conventional fuel prices continue to rise, traditional policies are no longer applied to new power sector economics, and both developed and developing countries face challenges to make renewable innovations better meet their policy objectives.

Traditionally, auctions were used to procure larger systems while feed-in tariffs (FITs) to procure smaller projects. France utilized a FIT system for a range of renewable energy technologies, while also procuring some technologies through tenders. Taiwan is using both a FIT policy and a competitive tendering scheme. Evidence from these countries demonstrates that policymakers can combine various elements of different policies together and focus on the underlying policy design

elements. Rather than comparing policies with traditional labels, policies can benefit from focusing not only on price but on alternative priorities, such as investor diversity. The outcomes ultimately depend on the design of the policy as well as related factors, such as the availability of debt financing, administrative barriers, and the full costs of project development.

Considering the challenges and benefits of policy interventions for renewable up-scaling, policy frameworks need to be adjusted. For example, offshore wind power becomes a rapidly maturing technology to accelerate carbon-neutral. Cost competitiveness and supportive policy framework help to bolster its growth, and annual offshore wind capacity are predicted to increase almost fivefold to over 20GW annually by 2030.

2.2 Integrating energy with environment

Energy and environment are inextricably linked. To address mounting greenhouse gas emissions, resource decisions need to transform from a cost-based sector to a dynamic sector that combines market and new technology. Integrating energy with environment can create a virtuous cycle of interdependence and support, which serves both energy reliability and affordability. For example, in the United States, the cooperation between energy and environment is written into statute so that decisions should consider both environmental and energy goals.

The development of renewable generation provides good opportunities to integrate the needs and goals of environment and energy. The EU offers examples like European Renewables Directive to integrate energy and environment decisions to combat climate change. In China, pollution and resource constraints have pushed environmental objectives to the top of the national agenda in the form of an all-encompassing government directive for “emission reductions and energy conservation.”

Climate change is a global phenomenon, its solution requires a complex, sustained response. A few countries have explored phasic solutions. For instance, China adopted a new rule based on a combination of thermal efficiency and pollutant emissions. The EU promoted product-specific requirement on energy efficiency to improve the lifecycle environmental performance of energy-related products. A holistic approach to integrate environmental and energy resources is the future for synergistic solutions.

3. Climate finance

3.1 Global landscape

Climate change has important financial and economic implications. After the Paris Climate Agreement signed in 2015, national policies and market signals are starting to reflect the urgency both of increasing finance for mitigation and adaptation to the effects of climate change. Average annual flows rose to US\$632 billion over the two-year period of 2019/2020, of which public finance representing 51% and private finance accounting for 49%.

Mitigation finance meeting high energy demand, accounted for 90% of total flows in 2019/2020, or US\$571 billion annually on average. Adaptation finance made up another 7% of flows though remains well short of estimated needs. A further US\$15 billion went to projects with dual benefits for mitigation and adaptation. Renewable energy remains the largest mitigation sector and represented 57% of total mitigation finance in 2019/2020. The private sector provided, on average, 69% of renewable energy finance. Solar PV and onshore wind continued to be the main recipient of renewable energy finance, attracting over 91% of mitigation investment.

3.2 MDBs

In September 2019, at the UN Secretary General’s Climate Action Summit, the Multilateral Development Banks (MDBs) announced their annual climate action targets for 2025: at least US\$65 billion of climate finance in total, an increase in adaptation finance to US\$18billion, and co-financing of US\$110billion. Many MDBs are well on track to scale up climate finance and have announced new commitments for the post-2020 period. For instance, AfDB has pledged at least US\$25 billion between 2020 and 2025, and AIIB will aim to reach or surpass by 2025 a 50% share of climate finance in its actual financing approvals. Green finance is to account for more than 50 % of total annual EBRD investments by 2025.

The MDB climate finance commitments include two main groups: low-income and middle-income economies, and

high-income economies. In 2020, the MDBs committed US\$66,045million in climate finance, including US\$49,945million or 76% of total for mitigation finance and US\$16,100 million or 24% for adaptation finance. In 2020, US\$38,306 million or 58% of total MDB commitments was for low-income and middle-income economies, and US\$27,739million or 42% was for high-income economies.

4. Global climate action

According to a September 2019 poll taken in the United States, Canada, the United Kingdom, Germany, Italy, Brazil, France and Poland, climate change ranks ahead of migration and terrorism as the most important issue facing the world. The COVID-19 pandemic, while first and foremost a public health crisis, has called attentions to advance climate action. Since the Paris Agreement was adopted in 2015, the world has shown some ambitious climate actions.

4.1 Technological Advances

Recently, renewable technology advances become increasingly cost-competitive. For example, electric vehicle technology improved so quickly that an increasing number of major automakers are planning to stop making internal combustion engines. Daimler aims to make new cars carbon-neutral by 2039 and to have no relevant impact on inner-city air quality. In the United States, clean energy already employs almost 3.3 million people, more than oil and gas industry does.

4.2 Public sectors are investing on green recovery

In the wake of the COVID-19 crisis, governments are providing unprecedented levels of investment, targeted to low carbon and climate resilient projects, to reflate economies and generate jobs. For example, South Korea invested more in green stimulus measures than any other OECD countries — and was one of the countries that rebounded the quickest. The EU is leading in green recovery. About 30% of its €750 billion (\$891 billion) EU-wide stimulus plan and its €1.1 trillion (\$1.3 trillion) 2021-2027 budget will be dedicated to climate-friendly investments.

More than half of the world's population lives in cities, and the U.N. predicts that percentage to grow to two-thirds of humanity by 2050. Many cities are taking actions to reduce emissions and create better lives for their residents. In China, the city of Shenzhen more than tripled its number of electric buses since 2015, making it the first city in the world to electrify 100% of its bus fleet. In the northern Indian, city officials are encouraging tactics to protect water bodies and boost resilience as monsoons get stronger and more unpredictable.

4.3 Private sectors are transitioning to green energy

Private sector leaders increasingly recognize that transitioning to low-carbon activities is not only essential to limit dangerous climate change impacts but also good for companies' bottom lines. For example, Nike already powers all its North American facilities through renewables. Air New Zealand, Baidu and HP have joined EV100, a worldwide initiative seeking to accelerate the transition to electric vehicles by 2030.

More than 130 private banks signed onto the Principles for Responsible Banking, the framework that seeks to align banking practices with the Paris Agreement. Through the United Nations-convened Net-Zero Asset Owner Alliance, 33 major institutional investors with \$5.1 trillion in assets committed to net-zero investment portfolios by 2050.

5. Conclusion

Slashing greenhouse gas emissions cannot be done overnight. Governments should continue to raise the level of ambition in national climate plans and allocate resources to enable implementation of these plans. Regulators also have a key role in supporting this development, by incorporating climate concerns into regulatory frameworks. It is estimated that to meet climate objectives, annual climate finance must increase by 588% to US\$4.35 trillion by 2030. The Paris Agreement calls for financial assistance from Parties with more financial resources to those less endowed and more vulnerable. Achieving net zero will require all public and private actors to align their finance with Paris goals.

Climate change is more than changes to the weather. The United Nations has defined 2021 as a critical year to "reset our

relationship with nature", calling for the international community to jointly cope with multiple crises, including climate change. The UN Climate Change Conference (COP26) presents opportunity for countries to show bigger ambitions and to reverse the trend of global warming. An agreement was reached on the fundamental norms related to carbon markets, which will make the Paris Agreement fully operational. Faced with unprecedented challenges in global environmental governance, the international community needs to come up with unprecedented ambition and action. Countries are expected to work together with solidarity and mutual assistance in tackling climate change and leave a clean and beautiful world to future generations.

References

- [1] CPI, 2021. Global Landscape of Climate Finance 2021. Climate Policy Initiative, London.
- [2] MDBs, 2021. 2020 Joint Report on Multilateral Development Banks' Climate finance.
- [3] Couture, Toby D. et al. (2015), The next generation of renewable electricity policy: How rapid change is breaking down conventional policy categories, Clean Energy Solutions Center.
- [4] Fishedick, Manfred et al. (2011), Towards global energy governance strategies for equitable access to sustainable energy, Stiftung Entwicklung und Frieden, Policy Paper 34.
- [5] Colburn, Kenneth et al. (2013), Integrating energy and environmental policy, RAP: Global Power Best Practice Series.
- [6] International Energy Agency (IEA) (2014), The climate-energy security nexus: Exploring impacts of a changing climate on the energy sector and options for resilience-building, Nexus Forum Summary Document.
- [7] Kucharski, Jeffrey and Hironobu Unesaki (2015), A policy-oriented approach to energy security, *Procedia Environmental Sciences*, 28, pp. 27-36.
- [8] Bergen, Molly and Helen Mountford (2020), 6 Signs of Progress Since the Adoption of the Paris Agreement, World Resources Institute blog post.
- [9] Rogelj, Joeri et al. (2016), Paris Agreement climate proposals need a boost to keep warming well below 2°C, *Nature*, 534, pp. 631-639.
- [10] United Nations (2015), The Paris Agreement on climate change.