Decreasing Cost of PV: Who Should Take Credit? : The Role of Government in Technological Progress

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Taishi Sugiyama

Price of Photo Voltaic power (PV) continues to fall. The bidding price in UAE recorded 3 cents/kWh. This, of course, is a figure for a sunny area with cheap land price, and the issue of the connection to the grid remains. Still, such a low price deserves praise.

As with all successes, everyone will claim credit for this one. But who actually contributed to this achievement?

1. Was it the Kyoto Protocol? Or Rather an Unintended International Cooperation?

Clearly, international treaties such as the Kyoto Protocol played no direct role. United Nations Framework Convention on Climate Change and the Kyoto Protocol did play an important role in establishing the fact that the global warming is not a pseudo-science, but a truly important political agenda, and was instrumental in encouraging each countries to adopt mitigation efforts with specific numeric targets. The specific items of the agreement, however, such as the commitment of each country to the implementation of their policies, as well as the submission and review of national reports and Kyoto Mechanism, had nothing to do with the decreased cost of PV.

What emerged instead was a case of “unintended international cooperation.”

The United States pushed their research and development (R&D) for their space development programs. Japan pushed R&D for 20 years as a part of their Sunshine Project. Germany pushed mass deployment through policies such as feed in tariffs (FITs), with UK, Spain, and China following suit.

This may sound as if the countries made a well-coordinated effort, starting from R&D, moving to implementation and finally to mass deployment. But in reality, this is not the case. Interestingly, the situation happened through sheer accident, without relying on any treaties or protocols, or

interventions from International Organizations, with each country simply promoting their own policies independently.

This happened because every country blindly believed that the use of PV must be good. In reality, PV may not be such an agreeable policy for global warming mitigation, considering the exorbitant cost it requires to reduce a ton of CO2. In spite of this, PV maintained its popularity.

But that's not all. It should be noted that the development of PV technologies and such has been considered to bring benefits to each country, even from a purely cost benefit standpoint. The actual results, however, clearly proves how misperceived this was. Germany and Japan both poured tens of billion USD worth of funds into PV deployment, hoping to establish a home grown industry in the field. In the end, however, only China scored a huge victory, with other countries left with a huge loss.

When there was no FIT, I remember, there were discussions at the International Energy Association (IEA) concerning international cooperation for technological development aimed at global warming mitigation. One of the proposals there was a global harmonization of supporting programs such as FIT. At the time, no country had adopted FIT, and no one thought any country would introduce such an expensive policy on their own, without international harmonization. Due to the misperception, however, the world just happened to engage in an unintended international cooperation.

2. Was it the FIT? Or Rather a Spillover from a Larger Technological Progress?

The story that FIT of various countries contributed to the cost decline of PV has been hailed as a leading success story of global warming mitigation led by policy interventions. The story further led to the argument that, in order to foster innovation to cope with global warming, strong government initiative is necessary. A famous advocate for this view in Europe is Mariana Mazzucato, in her The Entrepreneurial State.

It is true that huge government subsidy was made, and it is also true that PV cost decreased. However, as Professor Yoshioka=Kobayashi points out, this does not necessarily mean causality. FIT may have worked, but would there have been no technological progress without FIT?

Actually, drastic cost reduction similar to PV power has been observed in many other technologies. In the field of semiconductors, rapid progress has been made, known as the Moore's Law. Price decrease is not limited to memory chips and CPUs, but also for sensors. Battery cost have also seen a rapid decline . Shale gas have shown rapid increase in efficiency as well as cost decrease, with the pace that exceeded those of PV. None of these relied on huge government subsidies like FIT for PVs.

Reduction of the PV cost itself did not solely rely on FIT, but had other reasons. Even before PV, silicone semiconductor industry had already developed, producing an abundant accumulation of production and micro processing technologies. PV is a low-end semiconductor, so to say, and these stock of technology has been extensively applied to PV. Furthermore, low-cost manufacturing in China made significant strides, which was utilized in the PV production.

Even with much smaller FIT, PV technology may have grown autonomously (and with much higher cost-effectiveness), although it may have faced a couple of years' delay. The accumulation of technology in the semiconductor industry had been significant, and manufacturing in China was also developing, with niche market for portable use already well established. A parallel world with "huge PV cost reduction sans FIT" may well have been a reality, similar to cost reduction in shale gas and batteries.

3. A Suggestion: Role of the Government

Google developed an artificial intelligence (AI) using deep learning. Its application resulted in 40% reduction of air conditioning power consumption in its data center, and 15% energy savings for the data center as a whole. It should be noted that this saving was achieved completely independent from technology policy related to global warming issues. The progress of AI spilled over into energy savings. Likewise, Toyota used its numeric simulation technology extensively to reduce the cost of their hydrogen fuel cells significantly.

Looking at the long term toward the years 2030 or 2050—a typical time horizon of climate policy, a huge technological progress in General Purpose Technologies (GPT) such as Information and Communication Technology (ICT), material science and robotics can be expected, which should benefit every energy technologies---this is what is termed "spillovers" in the academic world. Energy savings, electric vehicles, PVs, and large scale technologies such as carbon dioxide capture and storage (CCS) and nuclear fusion, are all likely to be strongly affected by such spillovers.

If this is the case, there are two roles for the government.

Clearly, it needs to accelerate basic R&D for the overall progress of science and technology. It is widely agreed that the private sector will underinvest in these areas, and therefore, government needs to step in.

The problem is how to advance the so-called applied technology for global warming mitigation.

Considering the importance of spillovers as mentioned above, government assistance to the mitigation technology for global warming should not be an overly ambitious one that attempts to “solve the problem from scratch,” so to say. Rather, it would be more realistic to aim for the following: to catch the fruit of the overall development of science and technology in general in a timely manner, and then utilize them to achieve the policy goal of global warming mitigation.

This may sound like somewhat shying away from the original ambition. But a “supplementing the development of science and technology in general” is also a significant role, albeit in a secondary position. And such understanding of the government role may result in a more realistic and better technology policy, without the huge outlay of costs.