Feed-In Tariffs Can Help Research & Development

Financial incentives are key in spreading the implementation of renewable energy technologies. Since these technologies are relatively new, they are much more expensive than classical sources of energy (Read: fossil fuels). To be competitive in the modern market, they must be accompanied with monetary benefits. One of the most common and effective of these benefits is called a Feed-in Tariff (FiT). According to the U.S. Department of Energy, “A feed-in tariff is a requirement for utilities to purchase electricity from eligible renewable systems at a guaranteed price over a fixed period.” This is a standard definition of the modern Feed-In tariff, but policy details differ from country to country (or state to state). A utility is a power providing company – either government owned or privately owned – that controls the energy flow from supplier to consumer through the grid, or the electricity network. Though FiTs are proven to be successful in encouraging renewable energy growth, they have their shortcomings – one of which is their tendency to discourage Research and Development (R&D) of said renewable energy technologies. I propose that this deficiency can be mitigated if policies are changed to require FiT funding to contribute to R&D funding.

Typically, a modern feed-in tariff functions as follows: The renewable energy producer is connected to the grid. Any surplus energy he/she produces must be purchased by the local utility at a fixed price per energy unit. The fixed price is different for each renewable source, with the FiT for Photovoltaics (PV) being the highest of any renewable energy source. For instance, in 2009, the German FiT for PV was 43.01 eurocents while the FiT for on-shore wind was 9.20 eurocents. After the excess energy is purchased by the utility, the energy is distributed across the grid to other consumers. Because the utilities are mandated to pay renewable energy producers, they charge higher rates for electricity to make up for the loss. The raised energy bills
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mean a consumer who is not producing renewable energy will see the effect of a Feed-in Tariff through a higher energy bill. Consumers who cannot afford the initial investment for a PV system get higher energy bills with no compensation.

The idea of the tariff is to encourage renewable energy sources by guaranteeing producers payment as long as they are producing energy. A residential household with PV cells will either make a net profit if they are producing surplus energy, or they will pay lower utility bills if they are producing less energy than they use. A feed-in tariff essentially guarantees that the initial cost of buying a PV system will be paid back in time by consistent monetary benefits for producing renewable energy.

The first Feed-in Tariff system was actually implemented in the United States, although it was not nearly as sophisticated as modern FiTs. President Jimmy Carter signed the Public Utilities Regulatory Policy Act in 1978. The act was created during a time when oil prices were expected to rise significantly and suddenly. The act’s purpose was to promote alternative energy sources in the U.S. and reduce the country’s dependence on foreign oil. The act is still in place currently, but it is now practically useless. At first, it stimulated minor renewable energy growth in a few states, namely California, but when gas prices started returning to the normal low, the cost of renewable energy was no longer competitive with fossil fuels. PURPA was only effective when renewable energy costs could be competitive with foreign oil.

The first successful Feed-in Tariff system was the “Stromeinspeisungsgesetz” (StrEG) implemented in Germany in 1990. This law encouraged the implementation of renewable energy sources by forcing local utilities to purchase excess energy produced by non-utilities at fixed rates. The rates were defined as percentages of the avoided costs, or the market value of the equivalent amount of energy. PV, since it was the most expensive renewable energy source to
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implement, had the highest rate\(^5\). Another aspect of the StrEG, which is implied from the above, is that renewable energy producers are guaranteed access to the grid. In 2000, the StrEG was renewed under a new name, the "Erneuerbare Energien Gesetz" (EEG). Some notable changes from the StrEG were: 1) Utilities were forced to sign contracts with renewable energy producers guaranteeing purchases for 20 years. 2) Purchase prices were now based on cost of generation, meaning no matter the renewable energy source, there was a constant expected rate of return (around 5-10\%\(^6\) ) 3) Utilities could now participate - this encouraged utilities to make PV farms and other large-scale renewable energy sources. 4) The rates of payment now followed the expected cost reductions of renewable energy technologies\(^6\). This meant less cost for the government as the technologies develop. The EEG set the international bar for Feed-in Tariff laws and is still in place today.

Using the EEG as an example, there are numerous reasons supporters say FiTs are successful. But for each of these reasons, there is a counter-argument pointing out flaws. For example, the EEG is estimated to have created over 70,000 jobs in the German PV industry\(^7\). What’s more, the Ruhr University in Germany projects there will be some 400,000 jobs in the German renewable energy industry by 2020. Compared to the 2004 value of 160,500, this is a 250% increase\(^8\). Ruhr University, however, published an article in 2009 questioning whether FiTs have had a positive employment effect at all\(^9\). They contend that, among other things, the negative employment effect in other industries might outnumber the jobs created in the renewable industry.

Another common argument in support of FiTs is that they provide energy security and national dependence on imported fossil fuels. In fact, as I mentioned earlier, this is the reason FiTs were created in the late 70s. Reducing dependence on foreign oil is a goal for many a
country, and supposedly FiTs are a means of achieving this goal. Yet, once again, researchers at Ruhr University argue this point\textsuperscript{10}. Because renewable technologies are still young compared to more common sources of energy, their reliability is not fully trusted. This means there must be a back up system of energy supply at all times to protect against blackouts. This back up system must be based on a reliable source – foreign oil. Not to mention the continued reliance upon fossil fuels for transportation and other domestic demands. In other words, FiTs might be doing far less good than claimed by their supporters – and not only in reducing foreign oil dependence.

FiTs might also be less beneficial than suggested when it comes to renewable technology development as well. Though it cannot be argued that FiTs have sparked the creation of a massive renewable energy industry in Germany, they might be working backwards now. Since FiT rates decline annually, consumers are encouraged to implement renewable technologies as soon as possible. For instance, the sooner a citizen implements a solar cell, the higher his/her FiT rate is. Because of this, consumers are not waiting for better, more efficient solar cells to hit the market. By consequence, solar companies are putting less money into Research and Development and more money into production\textsuperscript{11}.

How can we go about fixing some drawbacks of FiTs? To stay within the scope of this paper, I will offer a single suggestion to improve Feed-in Tariff policy. The suggestion addresses what I consider the largest drawback of the FiTs: they take renewable energy companies’ focus away from Research and Development. From here on, I’ll mainly be addressing this issue in the solar industry specifically. R&D is especially important for PV, which is still an inefficient technology. Solar potential is truly astounding, with some sources estimating the global solar power potential to be over 600 TW\textsuperscript{12}. Funding R&D in the PV industry is critical in harnessing more of this solar potential. R&D for PV mainly means developing more efficient solar panels.
Efficiency is a measure of how much of the sun’s energy is being converted to usable energy. For example, the efficiencies of residential solar panels are all below 20%, meaning less than 20% of the sun’s energy is being used. The highest efficiency achieved in a laboratory is over 40%, and the high theoretical limit on efficiency is about 70%\textsuperscript{13}. But to reach those higher efficiencies, much more R&D is required. Unfortunately, R&D funding is miniscule when compared to money spent on FiTs (see later calculations). Yet the more money put towards R&D, the quicker solar potential can be used.

I suggest bringing R&D back into focus by contributing 3% of all FiTs to R&D funding. Specifically, I suggest contributing that 3% to the R&D department of the appropriate green energy company. For instance, citizens utilizing solar power would contribute 3% of their net FiT payments to the company that manufactures their solar panels. If mandated by federal law, this system would spark R&D for all green energy solutions and have only a minor effect on an individual basis. Any taxpayer who is not taking part in renewable energy production wouldn’t notice a change from the normal FiT system. Small-scale renewable energy producers, or people who receive FiTs, would notice a small loss in the long run. However, each renewable energy company would notice a massive increase in R&D funding.

How big would the increase in R&D funding be exactly? To provide an example, I’ll carry out this suggestion using data from Germany’s EEG system. In 2007, Germany’s population spent a total of 7.59 b\textsuperscript{14} on FiTs for all renewable energy technologies (PV, wind, biomass, etc.). That same year Germany spent an estimated total of 211 m\textsuperscript{15} on R&D for all renewable energy technologies. If 3% of the total FiTs paid, a hefty 228 m\textsuperscript{15}, were to be contributed to R&D, the annual R&D budget would more than double in size. In 2006, the total FiT payments spent on only PV technology totaled to 114 b\textsuperscript{16}. That same year, Germany spent
57 m² on PV R&D. 3% of the FiTs, some 34 m², would increase R&D funding by over 60%. Energy users fund FiTs, while corporate energy technology companies fund R&D. As shown by the above calculations, the budget for FiTs is much larger, about two magnitudes larger, than the budget for R&D. In this case, small contributions from many sources (taxpayers) seem to completely overpower large contributions from few sources (companies). My suggestion would slightly augment the contribution from the energy technology companies with a small percentage of the taxpayers’ potential. What better source to increase R&D funding? Because of the sheer amount of individuals who receive FiTs, there is no other source of funding that would contribute so much with such a small cost to the individual.

To justify that the cost to an individual is indeed small, I will give an example. In 2010, the state of California made FiTs available to residential PV users. Under this policy, the FiT rate is equal to the Market Price Referent (MPR) value of energy. Unlike Germany, where the FiT rate for Solar is much higher than the Market Price of energy, California does not have a built in incentive in the FiT rate. Based on data given by the California Public Utilities Commission, the 2011 MPR, and thus the FiT rate, is 0.10442 dollars/kWh. Using a 5 kW PV system in Northern California and the current MPR, I can find a rough estimate of total FiT payments over 25 years (the length of a warranty from solar cell producers, SunPower.) Assuming there is
about 10 hours of usable sunlight in a day, there is about 300 usable hours in a month. In 300 hours of sunlight, a fully functional 5 kW system will produce 1,500 kWh of energy. Using the current MPR, this amount of energy will be bought back into the grid for about $160. Assuming that the 5 kW PV system is properly maintained over the next 25 years and suffers no loss in production, the total FiT payments will come to $47,000. Over those 25 years, 3% of the total FiT payments comes out to $1400, or $4.70 per month. In Germany, where the FiT is five times higher than in California\textsuperscript{21}, 3% of the monthly FiT payment is $24.66, or $295.90 per year. Though there would be a higher monthly payment in Germany, there would also be a higher profit for an individual over any amount of time because of the higher tariff rates. However, the point is 3% of FiT payments over a lifetime is a drop in the bucket.

Is the overall investment in R&D worth the cost to each individual? In the last 20 years, since PV has started to get popular, researchers have made some massive progress in efficiency, manufacturing, and grid technology. The goals for the next 20 years are even more impressive. Universities and Institutions around the world, funded by grants from the renewable industry and the Department of Energy, are working on 4 main types of solar cells, with novel types in the work. Having the new R&D funds go directly to the Department of Energy would allow the DOE to fund more research by giving more grants worth more money to more researchers. It is up to those researchers to secure the future of solar energy by making it fully price competitive with fossil fuels. To do this, much higher efficiencies and much lower manufacturing costs are required. Neither of those goals can be reached without R&D funding. So yes, putting money towards R&D is worth a small price to individuals.
Sources:


Endnotes:

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5 Electricity Feed-In Law of 1991 ("Stromemspeisungsgesetz"), 1.
6 Renewable Energy Sources Act
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19 Feed-In Tariff Price, 1.
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