

# Policy Paper

## Strengthening Renewable Energy Expansion with Feed-In Tariffs: The German Example

Prepared by:

**Dr. Camilla Bausch  
Michael Mehling**

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## List of Abbreviations

EEG	Renewable Energy Sources Act
FiT	Feed-in tariff
GHG	Greenhouse gases
IRENA	International Renewable Energy Agency
MW	Megawatt
NGOs	Non-Governmental Organizations
PV	Photovoltaic
R&D	Research and development
RE	Renewable energy
RPS	Renewable portfolio standard

*„We are like tenant farmers chopping down the fence around our house for fuel when we should be using Nature's inexhaustible sources of energy — sun, wind and tide.”*

Thomas Alva Edison (1931)

## Introduction

Energy development pathways around the world are driven by different goals which either alone or in combination determine national energy policies. Some of the main goals<sup>1</sup> include:

- Furthering climate protection by greenhouse gas (GHG) emission reduction;
- Strengthening energy security by developing national or diversifying energy sources;
- Furthering energy access, e.g. also in rural areas off the grid;
- Containing the cost of energy;
- Maintaining international competitiveness;
- Developing new market opportunities;
- Protecting the health of citizens, e.g. by reducing coal dust;
- Avoiding high-risk technologies, e.g. nuclear power.

The expansion of renewable energy (RE) sources can be considered favorable for many if not all of these goals.

Decision makers can take recourse to a portfolio of policy instruments to promote renewable energy expansion, including feed-in tariffs (FiTs), premium payments, renewable quotas obligations, subsidies e.g. for research and development (R&D), tax measures, and favorable loans. In practice, these instruments are applied alone or in varying combinations.<sup>2</sup> For example, the United Kingdom has implemented a combination of quotas and FiTs to promote electricity from RE; Germany, in turn, combines FiTs with premium payments. While a few decades ago, the emphasis in European countries lay on subsidizing research and development, the focus has since shifted to stimulating market demand.<sup>3</sup>

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<sup>1</sup> See also IRENA (2013), p.4.

<sup>2</sup> Diekmann et al. (2012), p. 16.

<sup>3</sup> Zhang (2013), p. 2.

In the electricity sector, FiTs have become a frequently used policy to stimulate demand for renewable electricity across the world. By now, this price-based approach has become much more popular than the other prominent policy- quantity-based quota obligations, which are also referred to as renewable portfolio standards (RPS).

FiTs are generally considered successful drivers of RE expansion and have led to a considerable increase of renewable electricity capacity.<sup>4</sup> Proponents claim that FiTs “generate the fastest, and lowest-cost deployment of renewable energy.”<sup>5</sup>

This paper describes some of the main features and success factors of FiTs. While it is impossible to outline all potential design options of a FiT system in this paper, the following describes some of the mainstream basic features. When considering certain features of a FiT, policy makers should take into account the fact that investors will regularly look for three important parameters: transparency, longevity, and certainty.<sup>6</sup> Any policy design that upholds these parameters while creating the right financial incentives and avoiding a prohibitive administrative burden will be more likely to attract investors than a design which provides the latter, but does not offer the same transparency and long-term certainty.

The report furthermore outlines the policy developments in Germany to demonstrate the evolution of one of the most prominent FiT-systems in the world.

## **Key Characteristics of a Feed-in Tariff**

Specific targets for RE expansion are a useful starting point for policymakers when designing a FiT to define the vision and level of ambition guiding the policy. Different to a quota-system, however, the price-based incentive system of the FiTs works also without defined RE targets.

If a target is to be set, it can be expressed as e.g. a percentage of RE in the overall electricity mix by a certain year (meeting 35% of electricity demand through renewables in 2020, for example). To provide a long-term perspective for the market and thus create reliable incentives, a long-term vision and interim goals are advisable. Binding (as opposed to aspirational) goals will create the strongest such signal.

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<sup>4</sup> Zhang (2013), p. 2.

<sup>5</sup> See, e.g., World Future Council (2007), p. 7.

<sup>6</sup> See, for example, Fulton (2012), pp. 1 sqq.

As mentioned above, FiTs create a price-based incentive system. They are linked to the amount of electricity produced (generation based). The policy maker sets a fixed price for a unit of renewable electricity (kWh) fed into the grid. Different prices can be defined for different RE technologies. Thus, FiTs allow for a technology-specific promotion of renewable energies, which can incentivize different technologies. These in turn improve due to economies of scale and scope. Because this means that not only the cheapest technology option at a given time and in a given country will receive support, it allows for policy-driven development of a portfolio of RE options. FiTs can thus help meet ambitious long-term RE expansion goals by incentivizing an array of technologies rather than one or two low-cost options only.<sup>7</sup>

To limit the amount – and thus also the cost – of supported renewable expansion, a policy maker can define technology specific limits – e.g. a threshold for Megawatt (MW) installed – which, if surpassed, trigger reductions in tariffs or even exclude the support for any further MW installed. Alternatively or additionally, the policy makers can fine-tune the rate of RE expansion by regularly adjusting the tariffs (see below).

### **Key Determinants for a Successful Feed-in Tariff**

The following key characteristics of FiT design have been identified<sup>8</sup> as crucial to trigger RE investments because they cater to investors` desire for certainty, transparency and longevity:

- Stable policy environment;
- Low administrative barriers;
- Guaranteed grid access;
- Long duration of FiT contracts.

Already in 2007, *Resch et al.* saw indications that “a long-term and stable policy environment is actually the key criterion for the success of developing markets for Electricity from Renewable Energy Sources. As can be observed in a country like France, high administrative barriers can significantly hamper the development of

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<sup>7</sup> Diekmann et al. (2012), p. 16.

<sup>8</sup> Zhang (2013), pp. 3 sq.; Resch et al. (2007), pp. 26, 28; see also World Future Council (2007), p. 5.

wind energy even under a stable policy environment combined with reasonably high feed-in tariffs.”<sup>9</sup>

In 2013, *Zhang* found that “[m]oving from no guaranteed grid access to guaranteed grid access can almost double wind installations in one year, *ceteris paribus*; extending the contract length by an additional one year of an original 5-year agreement will on average increase wind investment by 6% annually. ... A predictable long-term policy commitment is likely to be more effective than excessive short-run fiscal incentives to attract investment.”<sup>10</sup>

Thus, while the tariff itself is obviously important to ensure success of a RE support scheme, as it defines the potential rent, it is by no means sufficient to incentivize investments.

### **Getting the Tariff Right**

The tariff is usually a fixed amount of money, though it can also be e.g. a premium paid in addition to the electricity market price. In the most basic form of a FiT, the producer of renewable electricity does not act on the free market, but feeds electricity into the grid and receives the fixed tariff for each unit of electricity (kWh) provided. Depending on FiT design, different parties can be legally responsible for compensating the generators of RE – these include the utility or the grid operator.

The utility or grid operator typically passes the difference between the FiT and the wholesale price of electricity on to the consumer. The burden of paying the tariff is thus evenly distributed among energy consumers. It might be higher for some if exemptions are granted for others: exemptions may be considered necessary e.g. for energy intensive industries to avoid competitive disadvantages internationally, and the respective risk of “leakage” of certain industries.<sup>11</sup>

The challenge of designing a FiT for policymakers is that they must set the tariffs without knowing to what degree the financial incentive will incentivize RE investment and expansion – they can only go by current prices for RE materials and running costs of production units, estimating how much the tariff incentive will drive these down over time. They aim for a tariff level adequate to achieve the intended rate of RE

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<sup>9</sup> Resch et al. (2007), pp. 27 sqq.

<sup>10</sup> Zhang (2013), p. 4.

<sup>11</sup> Leakage refers to a shift of production or investment (and hence also jobs and greenhouse gas emissions) from a jurisdiction with stringent climate protection policies to one with less stringent ones.

expansion. The tariffs have to provide sufficient incentives for RE investment but avoid creating rent-seeking behavior.

If tariffs are too low, the rate of RE expansion will not suffice to reach the defined goals. If tariffs are too generous (either from the start or at a later in time as a result of new market development), the RE expansion might exceed the intended rate. Furthermore, excessive tariffs can diminish incentives for technological improvement; inflate prices for RE installations, and overburden consumers – the latter can in turn undermine public acceptance of FiT policies. Depending on the design, inflated tariffs might impede economic growth and affordability. The latter is of particular concern in developing countries<sup>12</sup> and for low-income households.

While the tariff is not the only driver for the expansion of a certain RE technology (see above), examples in Germany and Spain have also shown how high rents can trigger massive investments. Thus policymakers must choose tariff levels carefully and adjust them over time to reflect e.g. technology-specific changes in the market due to economies of scale and due to changes in the price of materials needed to build renewable production units (e.g. steel, cement). Policymakers must be transparent about

- how often they will consider revisions of the tariffs (e.g. once a year or once every six or three months);
- the maximum reduction/increase of a tariff within one revision (e.g. a maximum reduction of 10% for the tariff granted); and
- whether and how they plan to use the design option of a degression rate (e.g. degression of tariffs for new installations of 1% every month).

In practice, different countries have chosen different tariffs, based on e.g. differences in RE potential in different regions and for different technologies. The German developments described below exemplify the differentiation and evolution of tariffs and tariff structures over time.

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<sup>12</sup> Zhang (2013), p. 3.



## Controversies

There has been a lively debate over advantages of FiTs, especially in comparison to quota-systems, in the EU from the late 1990s. Attempts by the European Commission to impose a Europe-wide harmonized system of green certificates, however, failed.<sup>13</sup>

The controversies regarding the policy approach arise over different issues, including the cost-effectiveness of FiTs.<sup>14</sup> There are strong indications, however, that the FiT might in practice be more cost-effective than a quota system due to the higher investment certainty which drives down financing cost. In a quota system, the investor has to bear the risk of both the market price and the certificate price, leading to higher rents. Examples analyzed by *Resch et al.* show that “... certificate systems lead to higher producer revenues than FITs, which compensate for high investment risk. [...] The fact that expected profitability from the investor’s perspective is significantly lower for FITs is directly linked with a higher efficiency of this strategy because additional costs for consumers are lower.”<sup>15</sup>

Furthermore, quota systems in practice have often not achieved the RE expansion goal.<sup>16</sup> This has been claimed e.g. on the fact that penalty payments were too low to incentivize compliance. It shows, however, that while a FiT system is challenged by finding the right equilibrium to achieve the politically set expansion goals, an improperly designed quota system can also fail to achieve RE targets.

## Case study: The German Feed-In Tariff System

### Germany as a Member State of the EU

The last two decades have seen a considerable expansion of RE in Europe. In the EU, not only national but also European policies triggered national action. One of the early elements for this development was the introduction of Directive 2001/77/EC on renewable energies in the electricity sector. The directive required “national indicative targets” and respective “appropriate steps” (Article 3 of the 2001 RE Directive). This incentivized legislative action at the national level in each Member

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<sup>13</sup> For more information see Mehling et al. (2013), pp. 29 sq.

<sup>14</sup> See Zhang (2013), p. 2; Diekmann et al. (2012), pp. 18 sqq.; Resch et al. (2007), pp. 27 sqq.; Bardt et al. (2012), p. 31.

<sup>15</sup> Resch et al. (2007), p. 29.

<sup>16</sup> Bardt et al. (2012), pp. 7, 8, 10; Diekmann et al. (2012), p. 18.

State, in terms of both RE support schemes and other aspects like planning procedures.<sup>17</sup>

The share of renewable energy sources increased by over 50% between 1997 and 2007. The indicative European target of a 12% share of renewable energy in gross inland consumption by 2010, however, was not achieved.<sup>18</sup> This was explained *inter alia* by the purely aspirational nature of the targets, and the ample discretion afforded to Member States in their implementation.<sup>19</sup>

To improve the situation, the EU adopted a reform of its RE legislation in 2009 (Directive 2009/28/EC), operationalizing the binding EU target which had been agreed upon in 2007: a 20% share of RE sources in final energy consumption by 2020. The revised directive specified binding targets also at the national level, taking into account past progress and economic potential of each Member State. For Germany, the RE target was set at 18%.

However, Germany – together with two other European countries in the joint “International Feed-In Cooperation”<sup>20</sup> – criticized that the directive provided an option to comply with the RE targets by using a quota-like system: tradable guarantees of origin (“Green Certificates”).<sup>21</sup> While this report will not go into detail regarding developments at the EU level and in EU Member States other than Germany, the dynamic outlined above shows the close link between the German dynamic and the legal framework introduced by the EU.

## Set of Goals

The German RE policy finds its basis in a range of mid- and long-term targets on GHG emissions, energy demand and the share of RE, all of which are interrelated. For example, the GHG reduction target requires ambitious RE expansion. An absolute improvement of energy efficiency, in turn, can help achieve RE expansion targets by

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<sup>17</sup> Resch et al. (2007), p. 26.

<sup>18</sup> Eurostat (2012); European Commission (2011).

<sup>19</sup> Mehling et al. (2013), p. 29.

<sup>20</sup> The International Feed-In Cooperation (IFIC) is a project of Germany, Spain and Slovenia. These countries see FiTs as the most effective and efficient policy to promote renewable electricity production; for more information, visit the IFIC website at [http://www.feed-in-cooperation.org/wDefault\\_7/index.php](http://www.feed-in-cooperation.org/wDefault_7/index.php).

<sup>21</sup> This system of mutually recognized guarantees of origin had already been established by the 2001 directive, but it now acquired new relevance with the binding deployment targets. See also Mehling et al. (2013), footnote 19.

reducing overall energy consumption. The following chart describes the set of targets agreed upon by the German government in 2011:

Climate	Renewable Energy		Efficiency		
	Share Electr.	Share Total	Primary Energy	Energy Productivity	Building Renovation
Greenhouse Gases (vs. 1990)					
- 40%	35%	18%	- 20%	increase by 2.1%/year	doubling of rate 1% --> 2%
- 55%	50%	30%			
- 70%	65%	45%			
- 80-95%	80%	60%	- 50%		

Source: Federal Ministry for the Environment (2013).

### The History of German Feed-In Tariffs

Germany has been a pioneer in the adoption of a FiT system. By now, the German regime has undergone multiple stages of development. In its earliest stages in the 1990s, however, the German FiT had relatively little impact on the overall mix of electricity production. This changed with the introduction of the Renewable Energy Sources Act (“EEG”) of 2000. Three main phases of the EEG history can be identified (see also table below):<sup>22</sup>

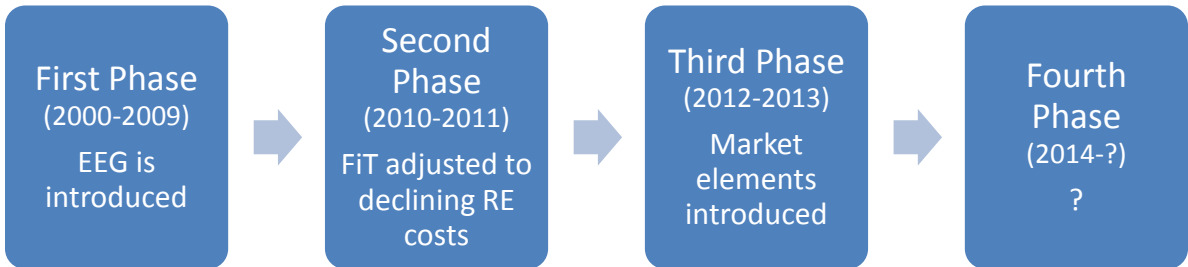
<sup>22</sup> Fulton et al. (2012), pp. 1 sqq.

Phase One (2000-2009): Germany introduces the EEG. The act is intended to scale up RE generation and provides all features that trigger interest by investors: transparency, longevity, and certainty. Tariff payments are guaranteed for a long period of time, degression rates are modest, and adjustment intervals are broad.

Phase Two (2009-2011): The unforeseen, massive decline in the cost of solar photovoltaic (PV) modules and an ensuing boom in the installation of photovoltaic panels triggers a controversial debate over excessive rents and the adequacy of the EEG. The FiT regime is adjusted, inter alia by lowering the photovoltaic tariffs, reviewing them more frequently and linking FIT degressions for PV to the aggregate volume of installations.

Phase Three (2012-present and beyond): With several RE technologies becoming increasingly competitive with traditional sources of electricity, the German legislature introduced new design elements aiming to bring RE electricity producers closer to the market. Furthermore, to limit the potential burden to electricity consumers due to PV expansion, a capacity threshold of 52 GW PV was introduced. While this is not an absolute cap, the regime foresees a change in the support scheme in case this threshold is passed. How the new regime for PV support would then look like remains unspecified. From an investor’s perspective, the third phase framework may offer less transparency and long-term certainty to investors than the FiT design in phases one and two.<sup>23</sup>

Phase Four can be expected to follow in the near future (see below, Section 3.4).



<sup>23</sup> Fulton et al. (2012), p. 1.

## Challenges

The EEG has seen several reforms over the past decades. They were regularly subject to political controversies,<sup>24</sup> which were in part driven by economic interest groups and environmental NGOs. Rapid growth in installed RE capacity in Germany during the last few years has also resulted in a rising FiT surcharge added to retail electricity rates. As this surcharge increased, it incurred criticism that promotion of RE sources was resulting in excessive electricity prices in Germany, with various undesirable consequences. From a distributional perspective, the FiT has been accused of being akin to a regressive tax, with negative impacts particularly affecting low-income households.<sup>25</sup> The exemption of energy-intensive, trade-exposed industries has only exacerbated the distributional challenges, and while it was introduced to address another concern of rising electricity prices – a potential impact on the competitiveness of German manufacturing industries – it has come under scrutiny by both domestic and EU regulators as a potentially illegal form of state aid and a politically unpopular mechanism shifting the burden of economic decarbonization to households and small- and medium-sized enterprises<sup>26</sup>. A future revision of the EEG is likely to address these criticisms by reducing or eliminating the preferential treatment of certain industries, and thus distributing the cost of RE expansion more evenly across the German economy.

Another growing concern under the EEG relates to the market design and structure, and notably the ability of the current electricity market to accommodate further increases in the share of RE electricity without undue economic and technological disruption.<sup>27</sup> As the share of RE sources has grown in the German electricity mix, it has not only begun eroding the market share of incumbent utilities, but more importantly, the low to negligible operating cost of most RE sources has substantially altered wholesale electricity pricing by displacing fossil fuel powered generation capacity with higher operating cost, and by providing ample low-cost electricity at peak demand times which traditionally offered the highest profit margins. Many traditional electric utilities are therefore facing an existential crisis, with a substantial part of their power plant fleet – notably natural-gas-fired generating capacity – becoming less profitable or even generating losses. Aside from the short-term economic disruption caused by this transition, potential threats to grid stability and the security of electricity supply may arise from a shrinking share of dispatchable generation capacity (such as that from gas-fired power plants) to balance variability

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<sup>24</sup> See also Mehling et al. (2013), p. 40.

<sup>25</sup> Bardt et al. (2012), pp. 22 sqq.; Neuhoff et al. (2012), pp. 1 sqq.

<sup>26</sup> Requesting respective reforms, e.g., Agora Energiewende (2013b).

<sup>27</sup> See, e.g., Diekmann et al. (2012), p. 20.

in RE sources such as wind and solar. Changes in the market design are therefore under consideration, with political proposals including payments for generation capacity provided by utilities rather than only actual electricity sold at auction.<sup>28</sup> Because such capacity payments could – depending on the design - incentivize the continued existence of high-carbon electricity generation technologies, however, they have many critics. It is as yet unclear what shape a potential reform of the German electricity market will take. This is, however, a challenge which arises due to the now already relatively high and rising RE quota and the specific market design of the German electricity sector.

Ultimately, as the scale and feasibility of RE grow and electricity generated through RE technologies becomes more competitive, support mechanisms such as the FiT will arguably become less and less relevant as an instrument to level the playing field vis-à-vis traditionally less expensive conventional electricity sources. The FiT is actually designed to make itself dispensable over time. To prepare REs for their participation in the market, in a first step, market premiums may be combined with FiT rates or replace them, and over time all incentives for RE may be phased out without slowing the further expansion of RE.

## **Outlook**

Already during the federal election campaign of 2013, there was consensus across party lines about the need to revise the EEG in order to address the price increase for German households and some companies due to the RE expansion under the FiT scheme, despite disputes over the exact features of such a reform. Thus, a fourth phase of the EEG can therefore be expected in the near future:

While there is no agreement yet over the exact features of the revised EEG, the new government of the conservative Christian Democrats under the leadership of Chancellor Angela Merkel and the Social Democrats agreed on a timeline: A first draft of a revised EEG is to be presented by Easter 2014, and the revised law is to enter into force beginning 2015. Both parties already confirmed their intention to continue with the expansion of RE in the German energy market.

Some observers expect that the group of companies benefitting from exemption rules regarding the FiT surcharge will be dramatically reduced (after having been expanded in recent years, resulting in massive controversies and public criticism). Furthermore,

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<sup>28</sup> Agora Energiewende (2013a); Agora Energiewende (2013b); see also SRU (2013).

the extent to which companies are exempted might be reduced – by increasing their comparatively small share of FiT payments. Furthermore, exemptions might get linked to prerequisites like the introduction of an energy management system in the respective companies. The necessity and urgency of such reforms is accelerated by the EU Commissioner for Competition, Almunia, who is requesting reforms, claiming that the existing exemption rules might be a subsidy in violation of EU competition law.<sup>29</sup>

## Conclusions

Promoting renewable electricity is a good means of furthering energy security by using energy sources available domestically and protecting the climate by avoiding CO<sub>2</sub> emissions from electricity production. At the same time, other risks related to many conventional energy sources are avoided, e.g.

- Health risks related to coal dust or nuclear contamination;
- Environmental risks related to the unsolved problems of disposal of nuclear waste;
- Security risks related to potential terrorist attacks, e.g., on a nuclear plant.

FiTs have proven to be a convincing instrument for RE expansion. With the right design, it can be considered both efficient and effective. Unsurprisingly, the instrument has enjoyed a high level of political support across the world and has been implemented in a rapidly growing number of countries. The experiences gained with this instrument in different nations and over different stages of RE development are a valuable source of information for future FiT design options. Ultimately, however, policy-makers will always have to take into account the specific circumstances and RE potential in their respective jurisdiction.

Some design elements of a FiT have, however, proven to be important for a successful regime:

- The FiT design will have to provide transparency, longevity and certainty to be attractive to investors.
- The FiTs have to incentivize the desired level of investment while avoiding excessive rents to RE generators. This is a central challenge and will require regular revisiting and adjustment of tariffs.

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<sup>29</sup> Stratmann (2013).

- Elements that strengthen a FiT approach include: priority grid connection, priority grid access, transparent long-term tariffs, and avoidance of excessive administrative burden.
- FiT design has to be adapted regularly over time as the market changes.



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### **About the Authors**

Dr. Camila Bausch is a Senior Fellow at the Ecologic Institute in Berlin, Germany.

Michael Mehling is the President of the Ecologic Institute's office in Washington, DC.

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Friedrich-Ebert-Stiftung Jordan & Iraq  
PO Box 941876  
Amman 11194  
Jordan

Tel. +962 6 5680810

Fax: +962 6 5696478

Email: [fes@fes-jordan.org](mailto:fes@fes-jordan.org)

Website: [www.fes-jordan.org](http://www.fes-jordan.org)

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