

D. Renewable energy targets

The renewable energy target was designed to reduce emissions of GHGs through the increasing use of renewable energy sources (RES) through financial incentives and other promotion offers [14]. In 2000, the goal of German renewable energy was to doubling the share of RES in electricity generation in 2010 compared to the 1997 level. Accordingly, in 2000, Germany set target of generating 12.5% of electricity from renewables by 2010, including large-scale hydro. Due to the positive drive of setting target, it achieved 17% renewable energy by 2010. Later in 2012, amendment to the EEG, it put a new long term target for renewable sources. According to this new target, 35% of German power supply is to be provided by renewable energy sources by 2020, 50% by 2030, 65% by 2040, and 80% by 2050. The corresponding quantities of electricity are aimed to feed into the power supply system. Germany also set targets for GHG emission reductions. Climate-change commission in 1991 recommended deep cuts in CO₂ emissions in Germany. According to this recommendation, the target to cut emissions was 30% by 2005 and 80% by 2050 [8].

E. Renewable energy obligation

For increasing the share of renewable energy sources in its fuel mix, Germany also laid obligation mandates for biofuels and heating demands as described below.

a) Biofuels obligation mandate

The biofuels obligation mandate under biofuels quota act set a target for a minimum level of biofuels share in road transportation. The obligation quota from 2010 onwards has been set to the level of 6.25% based on energy content. However, in 2015, the basis for biofuels obligation quota has been shifted from energy content to GHG reduction limit. According to this quota, the biofuels contribution for GHG emission reduction must be 7% by 2020 [7]. Germany also enacted biofuels sustainability law, according to this law, biofuel is sustainable only if it saves minimum 35% emissions compared to fossil fuels. Under biofuels sustainability law, biofuels must meet these criteria to qualify to be considered for biofuels obligation quota.

b) Heating obligation mandate

Germany also enacted heating obligation mandate for renewable energy. According to this mandate, owner of the new buildings are required to meet a portion of their heating and cooling demands from renewable resources. The permitted renewable resources are solar thermal system, biomass based system, geothermal energy, environmental heat. According to this mandate, in addition to the residential building, the public owned building are also required to meet a fraction of heating and cooling demand from renewable sources [7].

F. Incentive programs: Grant and capital subsidy

The market incentive programs in Germany were mainly meant for promoting renewable energy for heating. Capital subsidies up to 40% of investments costs are provided to individuals or small enterprises for installation of solar collectors for heating applications. Low interest loan with repayment subsidies are provided for large scale heating solutions for commercial customers or municipal bodies. Soft loans for biomass based combined heat and power, small hydropower, photovoltaic in schools are also provided. The interest rates were very low, 1% to 2% below market interest rate. Accelerated depreciations are also provided for owner or leaser of the buildings if they meet green building requirements.

G. Technical supports policy

Distribution system operators are obliged to optimize, reinforce and expand the networks in order to accommodate the electricity from renewable sources without delay. According to this policy, the networks are to be maintained to the updated standards so that it will not face problems to receive power from renewables. Policy is also aimed to provide suitable technical system solutions to fully integrate renewable power in the power grid.

III. RENEWABLE ENERGY POLICY IN MALAYSIA

To promote renewable energy, Malaysia introduces several policy initiatives, such as Fifth Fuel policy 2000, National Biofuel policy 2006, National Green Technology policy 2009, and National Renewable Energy Act 2011. The major tools under these policy initiatives are presented below.

A. FiT in Malaysia

Malaysia enacted FiT instrument through National Renewable Energy Act 2011 to encourage renewable based power generations [15]. This mechanism enables the entity or individuals to sell renewable based electricity (up to 30 MW) to power distribution companies at a fixed premium prices for a certain period of time (Table III). According to this policy, 1% of the electricity tariffs are imposed to the customers and manage a fund (RE fund) to support RE based generation (Fig. 3). The RE based plant operator are guaranteed for the premium from distribution companies. The FiT rates differ for various renewable source types and technologies. The FiT rates in Malaysia for different options are presented in Table III.

TABLE III. FIT RATES AND DURATION IN RE POLICY IN MALAYSIA, 2011

RE technologies/resources	FiT duration (y)	FiT rates (MYR*/kWh)	Annual degredation (%)
Biomass (palm oil, agro based)	16	0.24–0.035	0.5
Biogas (palm oil, agro based, farming)	16	0.28–0.35	0.5
Mini-hydro	21	0.23–0.24	0
Solar PV	21	1.25–1.75	8
Solid waste sewage	21	0.30–0.46	1.8
Wind	21	0.23–0.35	1.5
Ocean, geothermal	21	0.28–0.46	1

* MYR is Malaysian Ringgit

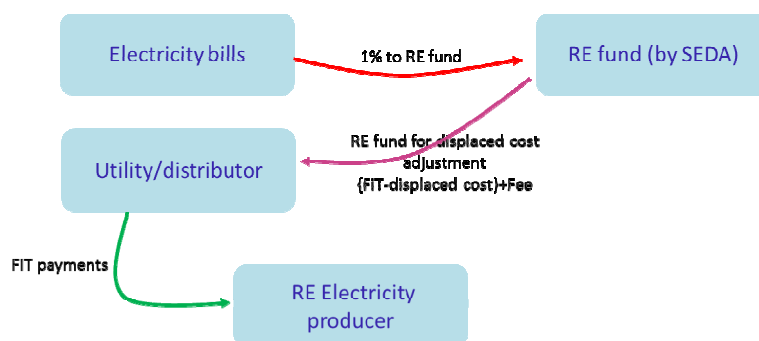


Fig. 3. Flows of money in Malaysian FiT

B. The major features of FiT in Malaysia

Access for RE based electricity into grid is legally guaranteed provided that technical and legal criteria have been met by the power producers [16]. Power distribution companies are obliged to accept the electricity from the power generators within the specified limit. FiT rates are contractually fixed for the effective period. The FiT law provides adequate degredation to promote cost reduction and grid parity. The RE law also facilities an online platform (e-FiT) to processing project application, quota balancing, monitoring and reporting modules, and payments.

C. Renewable energy targets

Malaysia set renewable energy targets to drive renewable energy dissemination through different policy frameworks [17]. In fifth fuel policy 2000, renewable energy was announced as a fifth fuel after coal, gas, oil, and hydro-electricity in the energy supply mix [18]. This country also announces bio-fuel policy to reduce the country's dependency on fossil fuels and promote the demand for palm oil. Lately it announced national RE policy 2010. The renewable energy targets for different years are presented in Table IV [5].

TABLE IV. RE TARGETS IN MALAYSIA

Year	Target RE cumulative capacity (GW)	Target share of RE mix in total power generation (%)	Anticipated annual CO ₂ avoidance (Mt/y)
2011	0.22	1	0.848
2015	0.99	5	3.715
2020	2.08	9	7.759
2030	4.00	12	11.889
2050	21.37	24	30.503

D. Renewable energy promotion programs

Malaysia initiated Small Renewable Energy Power (SREP) program in 2001 to develop RE resources for power generation fuels [19]. According to this program, the power plant developer can sign contracts with the power distribution utilities to sell their RE generated power to the utilities. The SREP licenses enable power generation from renewable sources such as biomass and biogas from palm oil mill wastes, solar photovoltaic, biogas from municipal landfills, mini-hydro, wind and municipal wastes. Maximum 10 MW power can be sold to the power utilities for 21 year period [20].

IV. SUMMARY OF MAJOR SUCCESS FACTORS IN GERMAN RE POLICY

The main success factors of Germany are summarized as follows. The most important factor was appropriate and dynamic FiT mechanism. German renewable energy programme realized that renewable energy diffusion is a dynamic process which cannot succeed by sticking to a rigid model. Thus the FiT features of Germany were undergoing continuous adjustments depending on the ever changing needs and evolving challenges. German RE policy ensures minimizing transaction costs by simplifying legal, technical, and financial processes. Germany also made obligation for renewable energy use in transportation and heating sectors. This country also ensures improvement of transmission and distribution system to accept power from renewable energy sources with having very low or zero refusal. Most importantly, German FiT mechanism provided that the FiT rates are negotiated to a level that yields marginal profits at current investment prices.

V. CONCLUSIONS

Energy policy is meant to address issues of energy developments including energy production, transformation, exploration, distribution and consumption. Renewable energy policy facilitates to adopt RE by dealing various barriers and challenging issues such as technological barriers, market failures, societal challenges, negative perception, higher transaction costs, competitors etc.

Germany is a very successful country for using renewable energy sources in terms of cumulative generation, per capital installed capacity, and current dissemination rates. The effective energy policy was the main driver for these achievements in Germany because 88% of renewable energy investment in power generation installation in 2011 was channelled through Renewable Energy Sources Act (EEG).

Malaysia also has initiated several policies and programs to promote renewable energy applications. The main goals of Malaysia RE policies were to encourage communities and individuals to adopt RE as alternative sources of energy. Despite several policy efforts, Malaysia renewable energy is not as successful as it desires. In this context, this article examines the renewable policy of Germany and Malaysia to figure out the main factors in Renewable energy policy of Germany that are missing in case of Malaysia. The authors found that the main success factors of Germany are appropriate FiT mechanism and supportive environment. German FiT mechanism gives that the FiT rates are negotiated to be such that at current investment prices, marginal profits are maintained. German RE policy ensures minimizing transaction costs by simplifying and transparent process. Germany also made obligation for renewable energy applications for transportation and heating sectors, which also made a great push towards wider RE deployment. Germany also ensures improvement of transmission and distribution system to adopt power from renewable energy sources. Germany also provides long term perspective for big investment and capacity expansion. Despite Malaysia RE policy deploy many good features for expediting renewable energy penetration, it clearly lack some of the features that German's RE policy has. Countries which are not successful yet in

renewable energy programme can upgrade RE policy based on German experience to facilitate further pace for renewables dissemination in their energy mix.

ACKNOWLEDGMENT

The authors express their gratitude to Universiti Teknologi Malaysia (UTM) for providing financial support through RUG (PAS) grant to perform this research work.

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