RMA Energy Consultants

RENEWABLE ENERGY DEVELOPMENT: POWER PURCHASE AGREEMENTS AND PRICING POLICIES

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Inter country comparison of SPP tariffs

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Abbreviations

A	Ampere
ac	alternating current
AD	Anaerobic Digestion
BERC	Bangladesh Energy Regulatory Commission
BOO	Build Own Operate
BOOT	Build Own Operate Transfer
BPDB	Bangladesh Power Development Board
CAD	Canadian Dollar
CCGT	Combined Cycle Gas Turbine
CDM	Clean Development Mechanism
CEB	Ceylon Electricity Board
CHP	Combined Heat and Power
CPI	Consumer Price Index
CSP	Concentrating Solar Power
DESA	Dhaka Electricity Supply Authority
DECC	Department of Energy and Climate Change
EGAT	Electricity Generating Authority of Thailand
EWURA	Energy and Water Utilities Regulatory Authority
FIT	Feed In Tariff
GERC	Gujarat Electricity Regulatory Commission
GOB	Government of Bangladesh
GWh	Gigawatthour
h	hour
IPP	Independent Power Producer
km	kilometre
kV	kilovolt
kVA	kilovolt ampere
kW	kilowatt
kWh	kilowatt hour
LKR	Sri Lankan Rupee
mA	milliampere
METI	Ministry of Economic Trade and Industry (JAPAN)
MVA	Megavolt ampere
MW	Megawatt
MWh	Megawatt hour
MYR	Malaysian Ringgit
NEPRA	National Electric Power Regulatory Authority(Pak)
NTB	West Nusa Tenggara (Nusa Tenggara Barat)
NTT	East Nusa Tenggara (Nusa Tenggara Timur)
OPA	Ontario Power Authority
O&M	Operations and Maintenance
PhP	Philippine Peso
PLN	Perusahaan Listrik Negara/ 'State Electricity Company'
PoS	Point of Supply

PPA	Power Purchase Agreement
PPP	Public Private Partnership
PURPA	Public Utility Regulatory Policies Act
PV	Photovoltaic
RE	Renewable Energy
REA	Renewable Energy Authority
REB	Rural Electrification Board
RET	Renewable Energy Technology
RO	Renewables Obligation
Rp	Indonesian Rupiah
SEDA	Sustainable Energy Development Agency
SERP	Small Renewable Energy Power Programme
SESB	Sabah Electricity Sdn. Bhd.
SLSEA	Sri Lanka Sustainable Energy Authority
SPP	Small Power Producer (or Small Power Plant)
SPPA	Small Power Purchase Agreement (of CEB)
SPPT	Standard Small Power Purchase Tariff
STM	Standardized Tariff Methodology
TANESCO	Tanzania Electric Supply Company Limited
TNB	TenagaNasionalBerhad
TWh	Terawatt hour
TZS	Tanzanian Shilling
USD	United States Dollar
V	Volt
VND	Vietnamese Dong
W	Watt
WGSPD	Working Group on Small Power Development

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1 INTRODUCTION TO THE STUDY

1.1 Objective of the study:

This study was conducted in order to compare tariffs paid to Small Power Producers (SPPs) of different countries, and to assess Sri Lanka's tariffs for renewable energy against prices paid in other countries. The study was extended by updating the previous country summaries, while including new countries to the database.

1.2 Data sources:

The initial study used most of its facts and data through web based literature. For the updating process, along with web based components more official documents were associated as data sources. Furthermore, data supplied from officials in the respective fields were also used in the updating process

1.3 Limitations:

Web based literature wasn't particularly reliable as most of the time these were published by non technocrats. It was a tedious process to refine and extract the accurate and essential data points from the relevant source in which for the academia to be prolonged. In some selected countries, though it is known that SPP's were existent, the government was hesitant to expose the tariff structures and policies. This caused much incomplete material while wasting time. Though these limitations existed, Accurate and reliable data was extracted and used in the updating process of the initial report.

1.4 Exchange Rates

India:	1 INR = 2.38LKR= 0.018 USD
United States of America:	1 USD = 132.32LKR
Canada	1 CND = 134.15 LKR = 1.016 USD
United Kingdom	1 GBP = 210.23 LKR= 1.593 USD
Thailand	1 THB = 4.24 LKR= 0.032 USD
Indonesia	1 IDR = 0.01 LKR= 0.0001 USD
Malaysia	1 MYR = 42.58 LKR= 0.323 USD
Japan	1 JPY = 1.69 LKR= 0.013 USD
Kenya	1 KES = 1.56 LKR= 0.012 USD
Pakistan	1 PKR = 1.39 LKR= 0.010 USD
Bangladesh	1 BDT = 1.61 LKR= 0.012 USD
Philippines	1 PHP = 3.16 LKR= 0.024 USD
Vietnam	1 VND = 0.0063 LKR= 0.000047 USD
Myanmar	1 MMK = 0.15 LKR= 0.001 USD

$ is assumed to be U.S. dollars throughout.

2 COMPARISON OF PPA DESIGN

Source: http://siteresources.worldbank.org/INTEAPREGTOPENERGY/Resources/Power-Purchase.pdf -*Obtained in Aug 2011*

Thailand was the first in Asia to establish a Small Power Producer (SPP) program, and it sets the standard for successful program development in Thailand as well as elsewhere in Asia.

The Indonesian SPP program began in 1993. It offered a standardized PPA and a standardized tariff. The program was designed to supply up to one-third of national new power supply from small, renewable sources up to 30 MW in size on the primary island, and half (15 MW) that size on smaller island grids.

In the state of Andhra Pradesh, no formally standardized contract is in place, although actually a set of contract form is used by the utility, leaving some case-by-case discretion with the utility. The tariff is increased by 5 percent annually from a base year. Moreover, the tariff can be reset mid contract after three years by the government. This undercuts long-term certainty. Energy wheeling is allowed, butdiscouraged economically by a high wheeling charge.

In Tamil Nadu state, a similar set of PPA is employed. An SPP is defined as any project up to 25 MW. Many wind power projects have been developed and grid connected. Wheeling of power to an affiliated location—not to a third-party—is permitted with a 2 percent charge. No third-party retail sales are allowed.

InSri Lanka, fifteen-year PPAs are available for projects up to 10 MW in size until 2007. After 2007 twenty-year PPAs are available for projects up to 10 MW. All but one of the successful SPPs to date is small hydroelectric projects. The PPA is standardized, as is the tariff. The tariff development was assisted by consultants provided by the World Bank. The tariff is revised annually based on a three-year fuel average, with a tariff floor of 90 percent of the original tariff underneath renewable projects.

- Although avoided cost concepts for establishing the SPP tariff are recognized in most nations, avoided cost concepts are applied differently in these nations' SPP programs.

- These Asian nations offer different forms of government and have different predominant fuel.

- Sources in their generation base (hydro, coal, gas, oil). Some of the national electric systems have an integrated high-voltage transmission system, whereas others have a disintegrated or island system, but there are key similarities.

- All are in need of long-term increases in power generation.

- All have the potential of small-scale renewable energy options.
- Each country is being approached by private developers who seek to develop renewable SPP projects.
- Each system employs ready to use a standardized PPA, although it is not necessarily a neutral or consensual document in all cases.

The PPA tariff in the Indonesia, Thailand, and Sri Lanka were designed to include capacity payments in the tariff for each kWh delivered, paid only if the SPP delivers energy.This was designed to provide the maximum incentive to the SPP for dedicated performance anddelivery of power at peak periods.

2.1 Comparative Program Overview

Table 2.1 – Comparative Program Overview

Country Program	Year Begun	Maximum Size (MW)	Premium for Renewable energy	Primary Fuel	Eligible PPA Solicitation
Thailand	1992	<60 or <90	Yes, competitive Bid	Gas	Controlled period
Indonesia	1993	<30 Java <15 other island grids	No	Renewable Energy	Controlled period
Sri Lanka	1998	<10	No	Early Hydro, Now wind after change of pricing policy	Open offer
India: Andhra Pradesh	1995	<20 Prior <50	Yes, in tariff	Wind	Open offer
India: Tamil Nadu	1995	< 50	No	Wind	Open offer

Source:http://siteresources.worldbank.org/INTEAPREGTOPENERGY/Resources/Power-Purchase.pdf -*Obtained in Aug 2011*

It is worthwhile to note two columns in this table. The fourth column implies that renewable energy SPPs have been subsidized by two of the five profiled programs. Thailand does so by providing a project-specific subsidy through a competitive solicitationprocess. Andhra Pradesh does so by providing a tariff in excess of true avoided cost for renewableenergy SPPs. The final column illustrates that some programs have an open offer to enter PPA that theSPP may accept. There is an outstanding PPA offer for SPPs to accept. Other countries which morecarefully ration the PPA opportunities utilize a controlled solicitation of offers from prospective PPAs toaward PPAs. Table 2.2 displays salient comparative elements of PPA design and contractual points in of theprograms surveyed.

2.2 Comparative PPA Elements

Table 2.2 – Comparative PPA Elements

Country program	*Standard PPA?*	*Maximum Years*	*Third-party sales*	*Self-service wheeling*	*Net meter–banking*
Thailand	Yes	20–25 firm 5 non firm	No, under consideration	No, under consideration	Yes, if <1 MW
Indonesia	Yes	20 firm 5 nonfirm	No	Yes	No
Sri Lanka	Yes	15 till 2007 20 after 2007	No	No	Not under any PPA, but through a special mechanism in which any company of individual can generate and bank.
India: Andhra Pradesh	Not formally, but a standardized form	20	No, previously allowed	Yes, but very expensive	Yes
India: Tamil Nadu	Standardized form	5–15	No, previously allowed	Yes	Yes

Source:http://siteresources.worldbank.org/INTEAPREGTOPENERGY/Resources/Power-Purchase.pdf -*Obtained in Aug 2011*

Table 2.3 displays salient comparative elements of the PPA tariff in the SPP program.

2.3 Comparative Tariff Elements

Table 2.3 - Comparative Tariff Elements

Country program	*Avoided cost basis*	*Indexed to foreign currency*	*Periodically adjusted*	*Design elements*
Thailand	Yes, energy and capacity payment for firm contracts only	No	Yes	Utility purchases 65% of off-peak Power
Indonesia	Yes, both energy and capacity (some of them are not)	Yes	Yes, for changes in avoided capacity cost	Differentiated for each island grid
Sri Lanka	Yes, energy only for agreements signed until 2007	Not directly, but price linked to dollar-denominated imported oil price	Yes, and includes foreign fuel component	Calculated annually, based on three-year moving average imported oil price
Andhra	Yes, not to exceed	No	Yes	Reset every three

Pradesh	90% of retail tariff			Years
Tamil Nadu	Exceeds avoidedcost	No	Yes	Higher tariff for biomass than wind

Source:http://siteresources.worldbank.org/INTEAPREGTOPENERGY/Resources/Power-Purchase.pdf -*Obtained in Aug 2011*

3 SRI LANKA PROGRAM SUMMARY

In the year 1996, the Government of Sri Lanka announced a standardized power purchase agreement and a standardized tariff for private developers of non conventional renewable energy based power plants of capacity less than 10MW. As at end of 2008, around 80 small power plants had been built by small power producers, under the small power producer (SPP) scheme. These newly built small power plants were built by private entities in which it supplied 4.2% of the total demand in 2008.
Sri Lanka's hydro electricity generation potential is not almost over. Small hydropower development sites in capacities of 250kW and 10MW have been developed or under the stage of development. Sri Lankan program has not utilized a controlled solicitation for SPP bids as was deployed in Indonesia and Thailand. In 2003 the program was modified to adopt a controlled solicitation process, with application fees and earnest money deposits from PPA recipients.

For PPAs signed before 2007: The tariff as eventually implemented is not indexed for foreign exchange risk, although it reflects the cost of imported fuel priced in foreign currency. It is paid in local currency on a kWh-delivered basis, which employs economic incentives rather than contract coercion to provide incentives for SPP delivery of power. This tariff structure contained the incentives for performance in the tariff itself. When the SPP delivers capacity, it is only paid for energy.

For projects signed after 2007: The tariff is technology-specific and cost-reflective, and the SPP has the option of selecting either a three- tiered tariff or a level sized(flat) tariff. The option is exercised at the time of signing the PPA. The Tariff scheme was updated in 2012.

Tiered option

a) Tier1 (first 8 years): Cash outflow will include, loan repayment for 6 years, annual O&M cost, return on Equity and fuel cost.
b) Tier 2 (next 7 years): Cash outflow will include, annual O&M cost, Return on Equity and fuel cost
c) Tier 3 (next 5 years): Cash outflow will include, annual O&M cost, Fuel cost and an Incentive payment.

Note: In all the three tiers, escalations will be applicable for O&M cost, Fuel cost and the incentive payment

Flat option

A constant tariff over 20 years in which the same cash outflows are taken with the year 1 estimated escalation applied to total Small power purchase agreement period. A single all inclusive tariffs are determined for each technology respectively.

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3.1 Primary Elements of the Sri Lanka SPP Program

1. **Process:** Open offer.
2. **Maximum size:** 10 MW.
3. **Tariff:** For projects signed up to 2007, based on the avoided cost of thermal energy. Hence the tariff is technology neutral. For projects signed after 2007, the tariffs are cost-based and technology-specific, and the developers have the option of selecting either a three-tier tariff or a flat tariff.
4. **Third-party retail sales:** No.
5. **Self-wheeling:** No.
6. **Energy banking:** No.
7. **Standardized PPA:** Yes.
8. **PPA term:** 15 years for PPAs signed up to 2007, 20 years for PPAs signed after 2007
9. **Subsidy or incentives:** SPP and IPP power equipment generally free from import tax, enjoy tax holiday if projects are implemented under Board of Investment rules.

Table 3.3.1 -Option 1: Three-tier Tariff

Three Tier Tariff (US cents per kWh)

Technology / Source	Escalable	Escalable	Non-escalable			Royalty to Govt, paid direct by the utility (% of total Tariff)
	Base O&M (year 1-20)	Base Fuel (year 1-20)	Year 1-8	Year 9-15	Year 16-20	Year 16-20
Mini-hydro	1.29	None	10.08	4.12	3.75	10%
Mini-hydro-local	1.32	None	10.32	4.22	3.84	10%
Wind	0.90	None	14.11	5.77	5.25	10%
Wind-local	0.93	None	14.49	5.93	5.39	10%
Biomass	1.05	9.28	6.15	2.52	-	None
Biomass 16yr onwards	1.31	9.28	-	-	2.29	
Agro & Indus	1.05	4.64	6.15	2.52	-	None
Agro & Indus 16yr onwards	1.31	4.64	0.00	0.00	2.29	
Waste Heat	0.36	0.00	6.38	2.61	2.37	None
Escalation per year from 1st January after the commercial operation date	6.14%	3.37%				

Table 3.3.2 - Option 2: Flat Tariff

(US cents per kWh)

Technology / Source	Non-Escallable
Mini-hydro	10.32
Mini-hydro-local	10.57
Wind	13.18
Wind-local	13.53
Biomass	17.85
Biomass 16yr onwards	-
Agro & Indus	12.28
Agro & Indus 16yr onwards	-
Waste Heat	5.89
Escalation per year from 1st January after the commercial operation date	

4 THAILAND PROGRAM SUMMARY

In Thailand, eligible project's requirements of those of the PURPA program in the United States, with size limitations up to 60 MW,and in some cases, 90 MW. State subsidies (helps) are provided on a competitive bidding basis that allows themaximum task of renewable SPP resources at the lowest kWh cost to the state. This competitive bidding process may be the most important point of the Thai program. The ultimateprice paid by EGAT for small renewable power is a function of two price components: a fixed energyprice plus a competitive bid and set renewable energy subsidy. By having potential renewable energyprojects bid for the amount of subsidy they require, the least-cost (subsidy) renewable projects areselected.

Although the generalenergy price is based on utility avoided cost, the small subsidy for successful renewable energy projectsprovides a premium above avoided cost. In return, the system benefits from the fuel source and supplydiversity that these projects provide. As in the U.S. experience, the majority of projects are natural gas–fired IPP cogeneration projects. Bothfirm and nonfirm PPAs are available. The contract was designed to be indexed, but instead is adjustedperiodically, for foreign exchange risk for capacity payments and fuel price changes for energypayments.

4.1 Primary Elements of the Thai SPP Program

1. **Process:** Controlled solicitation.
2. **Maximum Size:** 60 MW (90 MW with permission).
3. **Tariff:** Avoided cost to utility.
   For firm 20-year energy and capacity:
4. **Third-party retail sales:** No. Under consideration.
5. **Self-wheeling:** No. Under consideration.
6. **Energy banking:** Only for SPPs < 1 MW.
7. **Standardized PPA:** Yes. After 2001, because of excess capacity, EGAT purchases 100% of capacityrating of kWh on peak and 65% of capacity rating kWh off-peak. Therefore, project cannot supply and be paid for rated capability during off-peak periods.
8. **PPA term:** Firm, 5–25 years,Nonfirm, < 5 years.
9. **Subsidy or incentives:** Competitive bidding for five-year renewable subsidy.
   Up to $0.009 per kWh based on lowest bids.
   Equipment isdischarged from import tax.

5 INDONESIA PROGRAM SUMMARY

The Indonesianprogram began its development in 1993. It came to involve a standardized PPA andtariff. The SPP program was designed to supply, with capacity additions from small. Renewable sources upto 10 MW in size Because Indonesia comprisesseveral separate and not interconnected island grid systems and isolated diesel systems, this programdesign failed to address avoided cost and power requirements on a regionalbasis.Indonesian government has been proactive in the recent years regarding renewable energy purchasing from SPP's by introducing a Feed in Tariff structure. The main objectives of this structure are:

- To expand renewable energy development in all parts of Indonesia,
- To increase the investment of renewable energy,
- To increase the growth of renewable energy industry and jobs,
- To increase the ratio of electrified villages.

5.1 Primary Elements of the Indonesia SPP Program

1. **Process:** Controlled solicitation.
2. **Maximum size:** 10MW.
3. **Tariff:**

Under the latest regulations (Ministerial Regulation No. 04/2012) the feed in tariff system has been developed further to facilitate different sources of energy due to their merits.

A. Hydro < 10 MW

Table 5.1 Hydro Tariffs

No.	FIT (Rp/kWh)	FIT (US cents/kWh)	Interconnected with
1.	656	6.58	Medium Voltage
2.	1,004	10.48	Low Voltage

With Factor as follows :

F = 1 for Java and Bali Region,

F = 1.2 for Sumatera and Sulawesi Region,

F = 1.3 for Kalimantan, NTB and NTT Region,

F = 1.5 for Maluku and Papua Region.

B. Biomass < 10 MW (Based on Biomass and Biogas)

Table 5.2Biomass Tariffs

No.	FIT (Rp/kWh)	FIT(US cents/kWh)	Interconnected with
1.	975	10.17	Medium Voltage
2.	1,325	13.83	Low Voltage

With Factor as follows: Used to multiply and get the actual tariff for the region

F = 1 for Java, Madura, Bali and Sumatera Region,

F = 1.2 for Sulawesi, Kalimantan, NTB, and NTT Region,

F = 1.3 for Maluku and Papua Region.

C. Biomass < 10 MW (Based on municipal solid waste by using a zero waste technology)

Table 5.3Solid waste and zero waste Tariffs

No.	FIT (Rp/kWh)	FIT(US cents/kWh)	Interconnected with
1.	1,050	10.96	Medium Voltage
2.	1,398	14.59	Low Voltage

D. Biomass < 10 MW (Based on municipal solid waste by using a sanitary landfill technology)

Table 5.4Solid waste and sanitary landfill Tariffs

No.	FIT (Rp/kWh)	FIT(US cents/kWh)	Interconnected with
1.	850	8.87	Medium Voltage
2.	1,198	12.50	Low Voltage

E. Geothermal

Table 5.5Geothermal Tariffs

No.	FIT (US cents/kWh)	Interconnected with	Remark
1.	9.7 cent	High Voltage	Ministerial Regulation No. 02/2011

F. Feed-in Tariff for Photovoltaic and Wind are being processed.

6 ANDHRA PRADESH PROGRAM SUMMARY

In Andhra Pradesh state, there are no formally standardized PPA'sThe utility has employed a similar contract in all SPP transactions, thus making a standardized PPA contract, while still leaving extensive case-by-case discretion with the utility regarding which contracts to enter.The tariff, which increases at 5 percent annually from a base year, does not exceed 90 percent of the high-tension retail tariff. Moreover, the tariff can be reset midcontract after three years bythe government. This makes for project uncertainty and is a major problem introduced by project developers.

6.1 Primary Elements of the Andhra Pradesh SPP Program

1. **Process:** Open offer.
2. **Maximum size:** < 20 MW (was < 50 MW).
3. **Tariff:** Above avoided cost
4. **Third-party retail sales:** No (previously allowed).
5. **Self-wheeling:** Allowed with 28% wheeling fee plus $0.01 per kWh charge.
6. **Energy banking:** Allowed with 2% energy banking charge.
7. **Standardized PPA:** No (But a PPA contract).
8. **PPA term:** 20 years.
9. **Subsidy or incentives:** Federal loans with 1- to 3-year repayment moratorium.
   80% of capital cost can be depreciated against taxes in the first year.
   Give some allowancesfor PV systems.
   Equipmentsare exempted from sales tax.

7 TAMIL NADU PROGRAM SUMMARY

In Tamil Nadu state, no formal standardized PPA is employed, although the utility has employed the samePPA of its design in every situation, thereby creating a standardized PPA. This again leaves greatdiscretion with the utility. Wheeling of power to an affiliated location (not to a third-party) is permitted.ASPP is defined as any project up to 25 MW. The tariff is higher for biomass projects than for wind.There is no self-governing or currency risk making mechanism.

7.1 Primary Elements of the Tamil Nadu SPP Program

1. **Process:** Open offer.
2. **Maximum size:** < 50 MW.
3. **Tariff:** Above avoided cost.
4. **Third-party retail sales:** No (previously allowed).
5. **Self-wheeling:** Allowed with 2% wheeling charge for up to 25 km transmission;
   10% wheeling charge more than 25 km.
6. **Energy banking:** Allowed with 2% banking charge.
7. **Standardized PPA:** No (But a PPA contract).
8. **PPA term:** 5–15 years.
9. **Subsidy or incentives:**

   80% of capital cost can be depreciated against taxes in the first year.

   Give some allowancesPV systems.

   Equipments are exempted from sales tax.

8 GUJARAT PROGRAM SUMMARY

The Gujarat Electricity Regulatory Commission (GERC) launched its renewable energy policy in 2009, by initiating the solar power policy under the guidelines of the National Electricity act of 2003 and the guidelines of the National Electricity Policy 2005.

Since 2009, more than 80 companies have signed power purchase agreements worth an estimated 965MW in Gujarat. At first, progress was slow, with obstructions and financial difficulties holding up developers. However, the state is finally beginning to deliver on some of its early promise in which GERC expects many more to be commissioned by the year's end.

The Gujarat Electricity Regulatory Commission (GERC) has proposed the new feed-in tariff (FiT) rates for PV projects commissioned from January 29, 2012 until March 31, 2015. These new rates range from INR10.27 (US cents 21) to INR13.14 per kWh (US cents 26.8) and are applicable for ground-mounted, rooftop and concentrating solar power (CSP) systems.

CSP projects will be eligible to receive levelized tariff payments between INR12.45 (US cents 25.2) and INR13.14 (US cents 26.6) per kWh, while systems over 100kW are in line for tariffs from INR10.37 (US cents 21) to INR10.92 (US cents 22.1) per kWh. Rooftop projects under 100kW will still receive the greatest assistance, with subsidies ranging from INR12.6 (US cents 25.5) to INR13.24 (US cents 26.8) per kWh.

Another facet of the new FiT is phased subsidies. This will see large-scale PV and CSP projects receive roughly double the subsidy payment level during the first 12 years of operation than in the next 13 years. Tariff levels will also vary depending on whether or projects utilise an accelerated depreciation benefit.

8.1 Primary Elements of the Gujarat SPP Program

1. **Process:** Reverse bidding
2. **Maximum size:** <4MW
3. **Tariff:** Determined by Central government
4. **Third-party retail sales:** No
5. **Standardized PPA:** PPA contract
6. **PPA term:** 25 years
4. **Subsidy or incentives:** No cross subsidy charges are levied

9 PAKISTAN PROGRAM SUMMARY

Pakistan has an installed power generation capacity of approximately 20 GW. Though this seems a large amount, this amount serves only 55% of the total population in Pakistan in which a deficit of 3GW also comes along. The Pakistani government had invested on extracting renewable energy during the 1980's era, but the ventures weren't successful. Energy resources such as wind, solar and biomass remain untapped yet. In 2006, the Pakistani government initiated its first renewable energy policy and the proper adoption of renewable energy technologies (RET). Hydro sources are the only proper renewable energy source used until recent times when a 50 MW wind energy project was deployed in the Sindh region (Daily Times Pakistan, 2009).

Though Pakistan has only a limited number of renewable energy projects, its potential to host is enormous. For an example the technical potential for wind energy projects compared to India, but India has the fourth largest installed capacity for wind energy projects in the world (Asif 2009)

9.1 Primary Elements of the Pakistan SPP Program

1**. Approval Process:** Solicited and unsolicited

2**. Maximum size:** Upto 50MW

3**. Tariff:** Competitive bidding, Negotiations and Up-front tariff-setting

4.**Self-wheeling:** Allowed corresponding to a wheeling charge determined by NEPRA.

5.**Standardized PPA**Sale of all power to the grid system may be implemented through either build, own, and operate (BOO) and Build, Own, Operate and Transfer (BOOT) contracts between the parties concerned

6.**PPA term:**, valid for a period of not less than 20 years

7. **Subsidy or incentives:** Government of Pakistan offers subsidies to qualifying registered small hydro projects, based on the plant's rated capacity.

10 BANGLADESH PROGRAM SUMMARY

The Government of Bangladesh has decided to allow private investors to establish small power plants on a fast track basis, for generation of electricity for own use and sell the surplus to other users. The plant size could be in the order of 10MW, which could be built up in stages as necessary, and depending on the potential market and load growth. More than 80% of total population lives in rural areas. Different types of Renewable energy sources have been put into use as of the 2008 renewable energy policy of Bangladesh.

Wind energy has made its mark only along the limited coastal areas and offshore islands. Presently there are only 2MW of installed wind turbines at Feni and Kutubdia. Biomass is the most used source of energy in which electricity is generated in small scale. A solar photovoltaic system is in use and has an accumulated capacity of 12MW through house hold level installations. Micro hydro and minihydro has its limited potential in Bangladesh. Hydropower assessments have been done in some identified locations in which a range of 10kW to 5 MW of power could be extracted. Currently the Renewable Energy Research Centre of the University of Dhaka is researching on 1.1kW grid connected photovoltaic system along with other renewable energy sources such as bio-fuels, geothermal, wave and tidal energy.

10.1 Primary Elements of the Bangladesh SPP Program

1**. ApprovalProcess:** Open Offer

2. **Maximum size:** 10MW. Government considers special requests

3**. Tariff:** In areas covered by BPDB/DESA/REB, the tariff announced by GOB from time to time shall apply. In other areas GOB will not regulate the price of electricity which shall be negotiated between the sponsor and the consumers.

4. **Self-wheeling:**Allowed with a charge to the owner of transmission/distribution facilities. The wheeling charges are determined by BERC

5. **Standardized PPA:** Both in public and private sectors may be purchased by power utilities or any consumer through a mutual agreement

6. **PPA term:**, period of 15 years

7. **Subsidy or incentives:** 1. Renewable energy project investors are exempted from corporate income tax.

2 An incentive tariff may be considered for electricity generated from renewable energy sources which is usually 1.25 times the highest price of electricity by the utility from private generators.

11 JAPAN PROGRAM SUMMARY

The Japanese government has started to initiate to revive the renewable energy industry by implementing high feed in tariffs for wind, geothermal, solar, small scale hydro and biomass. This sudden incentive was implemented after the shock following the nuclear crisis which occurred on March 3rd 2011. As for the less usage of nuclear power, power shortages are expected and in return renewable energy would make a great role in playing to compensate the deficit.

Hydro electriccomprisesto 8 percent of the Japanese energy demand, in which virtually all possible sites are being utilized. Solar consists of only 1 percent of the total power generation. Japan also had offshore wind power potential, mostly in northern part of Japan. The geographical terrain of Japan is one with a lot of volcanic activity. Though much is not exploited as they are in national parks or hot springs resorts. Japan has been experimenting on ocean currents, tides and differentials in water temperature to generate power.

The tariffs play a power purchasing agreement of 20 years for all the technologies except geothermal which would be having a term of 15 years. The prices and other terms of the feed in tariff are fixed in which the REA and METI would review the system once every three years. The rates will be set to higher amounts for the first few years to encourage renewable energy investors.

11.1 Primary Elements of the JAPAN SPP Program

1. **Process:** Open offer.
2. **Maximum Size:** <30MW
3. **Tariff:** The feed in tariff rate and contract period shall be determined corresponding to the type, form of installation, scale etc
   :
4. **PPA term:** Small hydro, solar PV and wind power 20 years. Geo thermal 15 years
5. **Subsidy or incentives:** As the subsidy for building renewable electricity generation runs counter to the Feed in tariff system, the principle of subsidizing is proposed to be abolished. For compensation, a feed in tariff of higher value is implemented.

Table 11.1Japanese Feed in Tariff scheme

	Years	US cents/kWh
Wind	20	
<20 kW		69.09
>20 kW		27.64
Geothermal		
<15 MW	15	50.25
>15 MW	15	32.66
Hydro	20	
<200 kW		42.71
>200 kW<1 MW		36.43
>1 MW<30 MW		30.15
Photovoltaic's		
<10 kW for surplus generation	10	50.25
>10 kW	20	50.25
		48.99
Biomass (solid fuel incineration)		
Sewage sludge & municipal waste	20	21.36
Forest thinnings	20	40.2
Whole timber	20	30.15
Construction waste	20	16.33

12 MALAYSIA PROGRAM SUMMARY

The Malaysian government launched Small Renewable Energy Power Programme (SREP), on 11th May 2001. The launch of the Programme is among the steps being taken by the Government to encourage and intensify the utilisation of Renewable Energy in power generation.

Small power generation plants which utilize Renewable Energy can apply to sell electricity to the Utility through the Distribution Grid System. Project developers are required to negotiate directly with the relevant Utility on all aspects relating to the Renewable Electricity Purchase Agreement, including the selling price on a "willing-seller, willing buyer" and "take and pay" basis. The Renewable Energy electricity producers will be given a license for a period of 21 years, which will be effective from the date of commissioning of the plant. Under this Small Renewable Energy Power Program, the utilization of all types of Renewable Energy, including biomass, biogas, municipal waste, solar, mini-hydro and wind, are allowed.

Maximum capacity of a small Renewable Energy plant designed for sale of power to the grid must be 10 MW. A power plant can be more than 10 MW in size, but the maximum capacity that will be allowed for power export to the distribution grid must not be more than 10 MW.

In April 2011 Malaysia adopted a renewable energy feed-in tariff system and to benefit from tariffs, renewable developers need to conclude a RE Power Purchase Agreement with Distribution Levels (eg. TNB, SESB, public power utilities). Households already falling under the Small Renewable Energy Programme (SREP) can convert previous support into a Feed-in tariff. FITs are ranging over a 21 year period for PV and mini hydro and 16 year period for biomass and biogas, and have been fixed as follows

Table 12.1Malaysia Feed in Tariff Scheme

Source	Installed Capacity (MW)	Tariff (MYR/kWh)	Tariff (US cents/kWh)	Remarks
Biogas	Up to 4	0.32	10.28	Biogas registers a 0.50% Annual degression rate and Cumulative capacity targets of 20 MW by 2011, 100 MW by 2015 and 1, 410 MW by 2030.
	4 to 10	0.3	9.64	
	10 to 30	0.28	8.99	
Biomass	Up to 10	0.31	9.96	Biomass registers a 0.50% Annual degression rate and Cumulative capacity targets of 110 MW by 2011, 330 MW by 2015 and 1, 340 MW by 2030.
	10 to 20	0.29	9.31	
	20 to 30	0.27	8.67	
Small Hydro	Up to 10	0.24	7.71	Small hydro registers a 0% Annual degression rate and Cumulative capacity targets of 60 MW by 2011, 290 MW by 2015 and 490 MW by 2030.
	10 to 30	0.23	7.39	
Solar PV	Up to 4kWp	1.23	39.51	
	4kWp to 24kWp	1.2	38.54	
	24kWp to 72kWp	1.18	37.9	
	72kWp to 1MWp	1.14	36.61	
	1MWp to 10MWp	0.95	30.51	
	10MWp to 30MWp	1.14	36.61	

13 KENYA PROGRAM SUMMARY

Kenya has introduced a Renewable energy feed in tariff scheme in 2008

- To increase the electricity supply and
- To diversify the electricity energy sources.

The Kenyan FIT-scheme was revised 2010 with increments to wind and bio gas based tariffs.

Calculation of the FITs is based mainly on the generation cost, but other factors like avoided cost and international FIT-levels are considered, too. FITs are considered as maximum tariffs, so negotiations could be done for lower tariffs. Tariffs are differentiated by forms of energy. Also different tariffs are imposed for firm and non-firm power (electricity from sources with fluctuating supply). Tariffs are not differentiated by size, except for hydro). The tariff scheme is offered for a period of 20 years with no inflation indexing.

Table 13.1Kenyan Tariff Scheme

Technology type	Plant Capacity(MW)	Maximum firm power tariff (US cents/kWh) at the Interconnection point	Non Firm Power Tariff US cents/kWh
Geothermal	35-70	8.8	6.6
Wind	0.5-50	10	-
Biomass		10	7.5
Small Hydro	0.5 – 5	-	7.5
	5.1 – 10	10	7.5
Biogas		10	7.5
Solar	Off grid(0.5-10)	20	15
	National grid(0.5-50)	12	9

14 PHILLIPINES PROGRAM SUMMARY

Renewable energy act of Philippines took effect from year 2009 and it covers small power producers as well as various other aspects like feed in tariffs, incentives for renewable energy etc. The coverage of this act extends to Biomass, Solar, Wind, Geothermal, Ocean and Hydro.

Although the act has been active since 2009, feed in tariffs were approved only in July 2012. A feed-in tariff was approved that covers small hydro, biomass, wind, and solar.

To avoid the cost-overruns being experienced in countries like Germany, rates have been lowered based on updated construction costs (for example since solar is much cheaper to build now compared to what it was many years ago); its FIT rates are much lower. Rates are also based on higher capacity factors to ensure only more efficient plants participate. They also include the cost of operating plants and a reasonable return on investment for developers.

Rates will be reviewed in three years or when installation targets for each technology are met. The FIT will be in place for 20 years but could be adjusted for new projects if there are significant changes to the cost of a technology.

The newly approved feed in tariffs is as follows:

Run-of-river hydro	:	PhP	5.90	per	kWh	/	14.02	US	cents	per	kWh
Biomass	:	PhP	6.63	per	kWh	/	15.76	US	cents	per	kWh
Wind	:	PhP	8.53	per	kWh	/	20.28	US	cents	per	kWh
Solar	: PhP9.68 per kWh / 23.01 US cents per kWh										

15 VIETNAM PROGRAM SUMMARY

Vietnam employs an avoided cost tariff introduced 1st January 2009, together with a standardised PPA (to replace ad hoc project specific tariffs based on 12% return) for renewable energy SPP projects. Avoided cost is based on gas CCGT (which is the most expensive project and has gas price linked to the Singapore fuel oil price).As of 31 December 2010, 77 projects (734MW) have signed SPPAs under the ACT, of which 30 (256MW) are already in operation, and 47 are under development or in construction. All are small hydro projects. In the first six months of 2011, an additional 11 projects (92.3) MW signed an SPPA. In Vietnam renewable energy projects are supported by World Bank Renewable Energy Project, which provides finance (on-lending through participating banks).When the avoided cost structure is considered it encourages daily peaking small hydro projects with a seasonally and time-of-day differentiated tariff (high remuneration for dry season peak energy). 2011 tariff provided around 1000 VND/kWh for a well-designed daily peaking SPP project (5 US cents/kWh).Although avoided cost tariff structure rewards hydro projects well; it is too low for wind and biomass projects which led to issuance of a feed-in tariff for wind in June 2011 – at a rate of 7.8 US cents/kWh.

15.1 Primary Elements of the Vietnam SPP Program

1. **Maximum size:** < 30 MW
2. **Tariff:** Avoided cost tariff (in effect from 01/01/2009)

   Feed in tariff for wind of 7.8 US cents/kWh (in effect from June 2011)
3. **Fiscal Incentives:**
   - Corporate income tax incentive rate of 10% for a period of 15 years to newly established enterprises investing in power plant projects.
   - Exemption of import duties for equipment and machinery imported to create fixed assets of the RE projects.
   - Exemption/reduction of land use fee/rental (depending also on the location of the projects).
3. **Subsidy**: Price subsidy for Clean Development Mechanism (“CDM”) projects which have production costs greater than the contracting electricity selling price may file an application to the Environmental Protection Fund of Vietnam for a price subsidy. For wind power: 207 VND/kWh (1.0 US$ cent/kWh).
4. **Duration of Power Purchase Agreement**: 20 years
5. **Major conditions for the Investor:**
   - Have experience of at least 5 years in project implementation
   - Obtain written agreement on the purchase of electricity by the Electricity of Vietnam or electricity wholesale or retail units
   - Prove sources of capital to be mobilized and loan commitments of credit institutions or banks for the project implementation
   - Have owner’s capital accounting for least 30% of the total investment capital (but could be lowered up to 20% in special cases).

6. Required forms for power projects: Must be in the form of a BOT/BOO project or other forms as provided for by law

16 TANZANIA PROGRAM SUMMARY

Tanzania power sources are a combination of hydro, geothermal, gas, methane, solar, wind, and thermal.The Energy and Water Utilities Regulatory Authority (EWURA) is developing a regulatoryframework for development of Small Power Projects (SPP) in line with the Energy Policy, of2003 in promoting the development of renewable energy sources in Tanzania. As a first stepEWURA developed standard Small Power Purchase Agreement (SPPA) and the standardSmall Power Purchase Tariff (SPPT) for Small Power Projects ("SPP") for renewable energybased and co-generation with capacities of up to 10MW.

Eligible Small Power Projects are those of capacity ranging from 100 kW to 10 MW and utilizing renewable energy *source,* intended to supply commercial electricity to the National Grid or isolated grids in Tanzania. The Government of Tanzania is expediting the development of renewable energy sources in Tanzania by promoting private sector participation in the power sector through the development of Small Power Projects (SPPs). The Standardized Tariff Methodology is normally subjected to revision in five years after approval except upon a major concern.

However, the tariff is adjustedannually to accommodate uncontrollable operational costs. The adjustments aredone by the Working Group on Small Power Development (WGSPD) currentlyhosted by the Energy and Water Utilities Regulatory Authority (EWURA).

16.1 Main –Grid Connection Standardized Small Power Purchase Tariff

1 TZS = 0.07349371 LKR = 0.000635 USD

Standardized SPP Tariff for year 2011	112.43 TZS/kWh	7.13 US cents/kWh
Dry Season (August to November)	134.92 TZS/kWh	8.57US cents/kWh
Wet Season (January to July, and December)	101.19 TZS/kWh	6.43US cents/kWh

http://www.ewura.com/pdf/SPPT/Draft%20SPPT_Public%20Notice_English%20version_18Feb2011.pdf*(obtained in Aug 2011)*

The proposed Tariff for the year 2011 for the sale of electricity to the Mini grids in Tanzania is in Table below.

16.2 Off-grids Connection Standardized Small Power Purchase Tariff

Standardized SPP Tariff for the year 2011	380.22 TZS/kWh	24.14US cents/kWh

http://www.ewura.com/pdf/SPPT/Draft%20SPPT_Public%20Notice_English%20version_18Feb2011.pdf (*obtained in Aug 2011)*

Tariff paid to all SPPs operating during the year will be the above standardized tariff, subject to the floor price and the price cap.

16.3 Floor Price and the Price Cap

The floor price for all SPPAs executed in year 2011 shall be the above tariffs. If the above tariffs are less than the floor prices stated in any SPPA, the floor price stated in such SPPA shall be paid.

The price cap shall be calculated as follows: The five-year moving average of the change in Tanzania Consumer Price Index (CPI), for the adjustment of the price cap of SPPs is 8.78%. The price cap stated in any SPPA signed in a previous year (already adjusted to account for any price cap adjustments announced in subsequent years prior to 2011) remaining valid as of 1st January 2011 shall be further increased by 8.78%.

To protect both parties (the SPP Developer and the DNO) against future price fluctuations, the SPP tariffs used in some cases include both a price floor and a price cap. The floor is equal to the tariff in the year in which the SPPA between the Seller and the DNO is executed.

That price is “locked in” for the duration of the PPA to protect the SPP against possible reduction in the standardized tariff in future years. If the calculated tariff in a particular year goes below this floor, then the floor price will be applied.

Similarly, if the calculated tariff rises above the price cap for a project signed in a particular year, then the price cap will be applied.

The price cap equals 1.5 x Standardized tariff for the year the PPA is executed. The price cap will be adjusted on an annual basis to reflect changes in the Consumer Price Index.

EWURA adopted a standardized mechanism for development of Small Power Projects(SPPs) in Tanzania for which Standardized Power Purchase Agreement (SPPA)for Main Grid and Off-Grid, and Standardized Tariff Methodology (STM) for Main Grid,was approved. The mechanism provides for annual updates of applicable tariff of powersold by SPPs, based on approved methodology.

16.4 Annual Tariff Announcement

An embedded generator is defined as a singlegenerator or a group of generating plant with a total export capacity between 100 kW and10 MW, connected to a distribution network in Tanzania, at 33 kV or below. For embedded generators of capacity less than 100 kW, a separate type approvalrequirement is to be implemented by the DNO.

Table 16.1 – Annual Tariff Announcement

Press Announcement: Tariffs to Small Power Producers on the Main Grid of Tanzania	2011	
Prices payable to Small Power Producers operating under the standardized Small Power Purchase Agreements (SPPAs) with TANESCO shall be as follows:		
Standardized SPP Tariff for year 2010	**112.43** TZS/kWh	8.26 LKR/kWh
Dry Season (August to November)	**134.92** TZS/kWh	9.92 LKR/kWh
Wet Season (January to July, and December)	**101.99** TZS/kWh	7.49 LKR/kWh
For new SPPAs signed during the year,		
-	The floor price will be the tariffs stated above.	
-	The price cap will be 1.5 times the tariffs stated above, subject to adjustment for inflation on the basis of the five-year moving average of Tanzania Consumer Price Index.	
Accordingly, for SPPAs that remain valid as of 1st January, the price cap shall be adjusted by **8.78%.**		

http://www.ewura.com/pdf/SPPT/2011%20SPPT%20Calculation%20for%20Main%20Grid.pdf (*obtained in Aug 201)1*

16.5 Standardized Small Power Purchase Agreement (SPPA)

An SPPA is a standard form contract between an SPP developer and the DNO for the sale and purchase of electricity. The SPPA also includes duties and obligations that bind both the DNO and an SPP developer, including:

(a) The grid interconnection requirements (specifying power quality standards, relay and other technical requirements for safe interconnection with the DNO grid).
(b) Metering arrangements.
(c) Billing and payment.
(d) Force majeure.
(e) Limitation of liability
(f) Dispute resolution.

To initiate the SPPA agreement process, a SPP developer shall complete and submit to the DNO information called for in “Application for Interconnection and Sale of Electricity”. All SPPs that do not sell electricity to a DNO are exempted from the obligation to execute an SPPA.

16.6 Retail Tariffs for Electricity Sold to Final Customers

A SPP developer selling directly to final (i.e. retail customers) must submit to EWURA an application for a cost-based tariff that is based on its own actual or projected total costs (expected to be largely generation and distribution costs) plus a reasonable profit for the

portion of electricity sold to retail customers. The SPP developer must decide whether its proposed tariff is:

(a) A conventional per kWh charge.
(b) A fixed monthly charge based on the number of lights and other appliances in the household.

17 BRITAIN PROGRAM SUMMARY

Feed-in tariffs in the United Kingdom were announced in October 2008 and took effect from April 2010.They were entered into law by the Energy Act of 2008

The Feed-In Tariff applies to small-scale generation of electricity, paying a fixed sum for eligible technologies. The tariff is available only to renewable sources producing up to 5 MW power. Specific rates are set for different technologies and at different scales of installation for those technologies.

The UK government has announced a new feed in tariff (FIT) system for renewable heat and small scale renewable electricity technologies. The changes will affect tariffs for all newly eligible FIT technologies from 1 December 2012 onwards. Changes to solar tariffs had already been announced and was taken place from 1st August 2012.

Under the new FIT program, a degressionmechanism will be introduced for anaerobic digestion (AD). Significantly, Department of Energy and Climate Change (DECC) is introducing a system of preliminary accreditation so all AD and hydro installations and larger wind and PV installations (over 50 kW) will be able to know before construction that they will be accredited. It will also provide certainty over tariffs for six months to two years depending on the technology. This means that if a developer gets their project up and running within the tariff guarantee timescale, they will get the tariff that applied at the time they applied for preliminary accreditation.

A system of advance tariff guarantees will also be available to non-domestic community energy PV projects up to 50 kW. A new hydro band for 100-500kW installations will also be introduced to ensure developers are incentivized to design their project at the most appropriate size.

- **Project Cap**: 5 MW
- Generator can be green field (doesn't have to be a metered customer)
- **Contract Term:**solar PV 25 years, Micro Combined heat and Power(CHP) (10 years), Others 20 years
- Costs for the program will be borne by all British ratepayers proportionally
- Existing systems installed before 15th July will qualify only if they are under 50 kilowatts and registered for the Renewable Obligation (RO)

Note: The RO is a regulation which requires licensed electricity suppliers ensure that an increasing proportion of the energy they sell comes from renewable sources

Table 17.1Renewable Electricity Tariff in Great Britain

Source	Capacity Range	Tariff US cents/kWh
Bio Gas	≤250kW	23.38182
	>250kW - 500kW	21.63216
	>500kW	15.74694
Hydro	≤15 kW	34.83414
	>15 - 100kW	31.17576
	>100kW - 2MW	19.24626
	>2MW - 5MW	7.63488
Micro-CHP	<2 kW	17.4966
Solar PV	≤4 kW	25.4496
	>4 - 10kW	23.0637
	>10 - 50kW	21.4731
	>50 - 250kW	18.2919
	≤250kW	11.29326
	>250kW - 5MW	11.29326
	≤5MW	11.29326
Wind	≤1.5kW	56.94348
	>1.5 - 15kW	44.5368
	>15 - 100kW	40.40124
	>100 - 500kW	32.76636
	>500kW - 1.5MW	16.54224
	>1.5MW - 5MW	7.79394
Any	existing systems transferred from RO	15.74694

18 CANADA (ONTARIO PROVINCE) PROGRAM SUMMARY

The Ontario Power Authority has developed this Feed-In Tariff Program for the Province to encourage a promote greater use of renewable energy sources including On-Shore Wind, waterpower, Renewable Biomass, Biogas, landfill gas and solar (PV) for electricity generating projects in Ontario. The fundamental objective of the FIT Program, in conjunction with the *Green Energy and Green Economy Act, 2009* (Ontario) and Ontario's Long Term Energy Plan, 2010 is to facilitate the increased development of Renewable Generating Facilities of varying sizes, technologies and configurations via a standardized, open and fair process. Solar (PV) Projects are subject to a maximum Contract Capacity of 10 MW and waterpower Projects are subject to a maximum Contract Capacity of 50 MW. The FIT Program is also subject to Procurement Targets.

Projects that are 10 kW or less in Contract Capacity may not apply to the FIT Program but may apply under the micro FIT Program and should refer to the Website, which contains the rules for this streamlined process.

Feed In tariff prices for renewable energy projects in Ontario (13th August 2010)

Table 18.1Tariff structure Ontario, Canada

Renewable Fuel	Size tranches	Contract Price ¢/kWh	Escalation Percentage[5]
Biomass[1,2]			
	≤ 10 MW	13.8	20%
	> 10 MW	13.0	20%
Biogas[1,2]			
On-Farm	≤ 100 kW	19.5	20%
On-Farm	> 100 kW ≤ 250 kW	18.5	20%
Biogas	≤ 500 kW	16.0	20%
Biogas	>500 kW ≤ 10 MW	14.7	20%
Biogas	> 10 MW	10.4	20%
Waterpower[1,2,3]			
	≤ 10 MW	13.1	20%
	> 10 MW ≤ 50 MW	12.2	20%
Landfill gas[1,2]			
	≤ 10MW	11.1	20%
	> 10 MW	10.3	20%
Solar PV			
Rooftop	≤10 kW	80.2	0%
Rooftop	> 10 ≤ 250 kW	71.3	0%
Rooftop	> 250 ≤ 500 kW	63.5	0%
Rooftop	> 500 kW	53.9	0%
Ground Mounted	≤ 10 kW	64.2	0%
Ground Mounted[2, 4]	> 10 kW ≤ 10 MW	44.3	0%
Wind[2]			
Onshore	Any size	13.5	20%
Offshore	Any size	19.0	20%

19 COMPARATIVE ANALYSIS OF PRICES PAID FOR SMALL POWER PRODUCERS OF DIFFERENT COUNTRIES

19.1 Energy Tariffs of Different Countries in Us cents/kWh as of 01/08/2012

Table 19.1 Feed in Tariff Country Summary

Country	Mini Hydro	Wind	Solar PV	Biomass	Biogas	Agricultural & Industrial Waste	Municipal Waste	Waste Heat Recovery	Wave Energy	Landfill Gas	Geothermal Energy
Sri Lanka	10.32	13.18	-	17.85				5.89			
Brazil	4.5	6.8		4.8							
Bulgaria	16.03	10.94	44.47	18.21	19.14	10.59	7.63	15.56			
Canada Ontario	13.02	11.43	34.79	13.72	14.61					11.03	
Ecuador	7.17	9.13	40.03	11.05	11.05						13.21
Germany	6.8	11	22.7	13.6	13.6	7.4	7.3			7.3	30.9
India Andhra Pradesh	5.04	6.3	27.98	8.01							
India Gujarat			20.08		9.21						
India Tamilnadu	5.14	5.42	26.83	8.42							
Japan	30.15	27.64	50.25	30.15	48.99	16.33	21.36				50.25
Kenya	10	10	20	10	10						8.8
Malaysia	6.95		27.5	8.98	8.69						
Mongolia	4.5	8	15								
Pakistan		15.3									
Phillipines	14.05	20.32	23.06	15.79							
South Africa	10.63	14.14	23.76							10.18	
South Korea	7.24	10.52	40.8							6.37	
Taiwan	7.31	8.76	23.12	7.31				9.00			16.09
Tanzania	6.75	6.75	6.75								
Thailand	23.7	10.38	23.72	1.48	1.48	10.38					
Turkey	7.3	7.3	13.3	13.3						13.3	10.5
Uganda	10.9	12.4	36.2	10.3	8.15					8.9	7.7

United Kingdom	19.24	7.79	11.29		15.74						
USA Wisconsin		7	11	8.6	8.2						
Vietnam		7.8									

Notes :

Tariff rates are in US cents per kWh
All tariff rates are taken for capacity < 10MW (For comparison with Sri Lanka)
Onshore wind tariffs were considered for the comparison
Flat rates have been taken for Sri Lanka
Brazil : Wind Tariff rate are for capacity factor of 34%
Bulgaria : Sewage waste tariff is considered as municipal waste tariff
Canada Ontario: Solar PV rates are taken for ground mounted
Ecuador: Rates in the main land has been considered
Germany : Manure waste power generation tariff is considered as Agricultural waste/ Industrial waste
India Gujarat : Levelizedtariffs are used
Japan: Sewage waste is considered as municipal waste. Whole timber is considered as bio mass
Kenya: firm tariffs are taken for the analysis
Malaysia: Rates are applicable except Sabah and Sarawak districts
Pakistan: Wind tariffs were the only transparent data
South Africa: Flat Tariffs are used
South Korea: Flat tariffs are used

19.2 Comparison of Tariffs of Different Countries

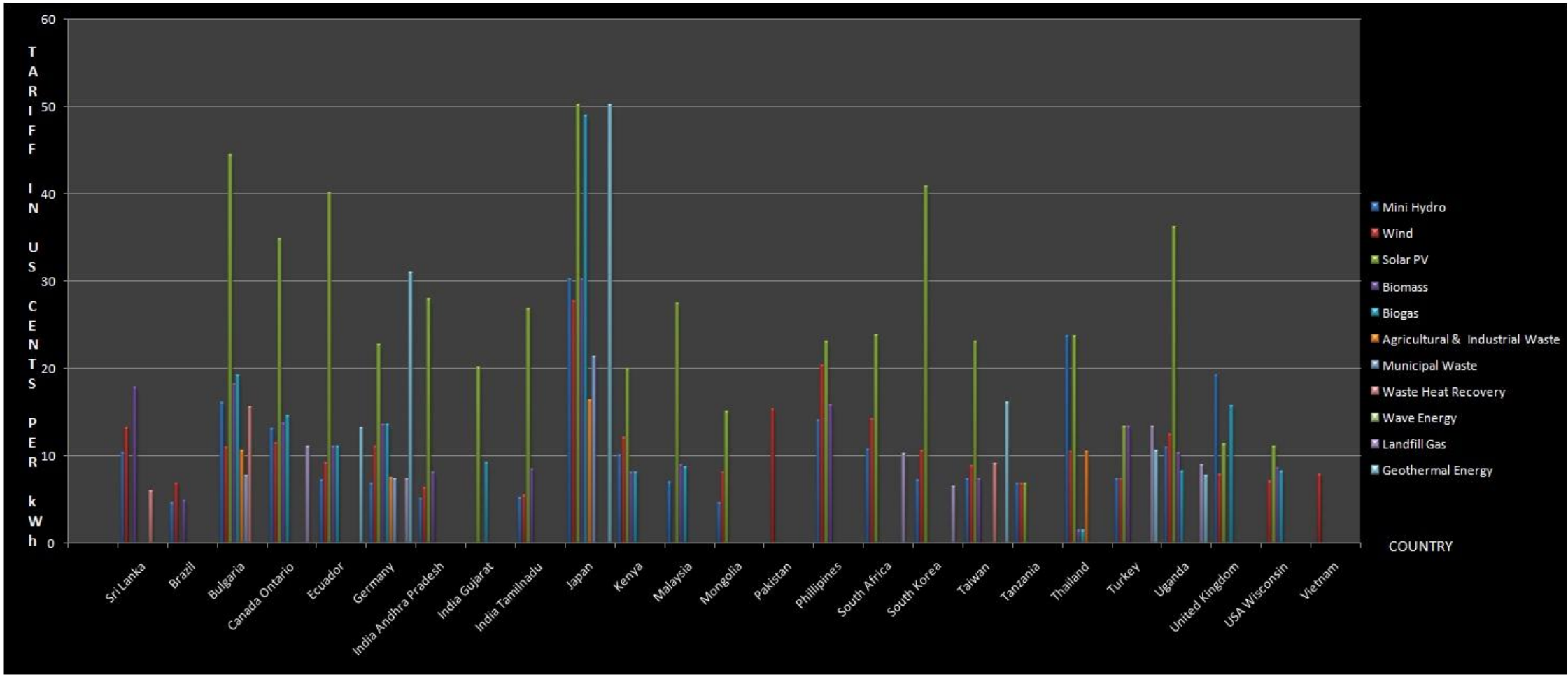


Figure 19.1 Feed in Tariff Country Summary

Figure 19.2 Mini Hydro Feed in Tariff

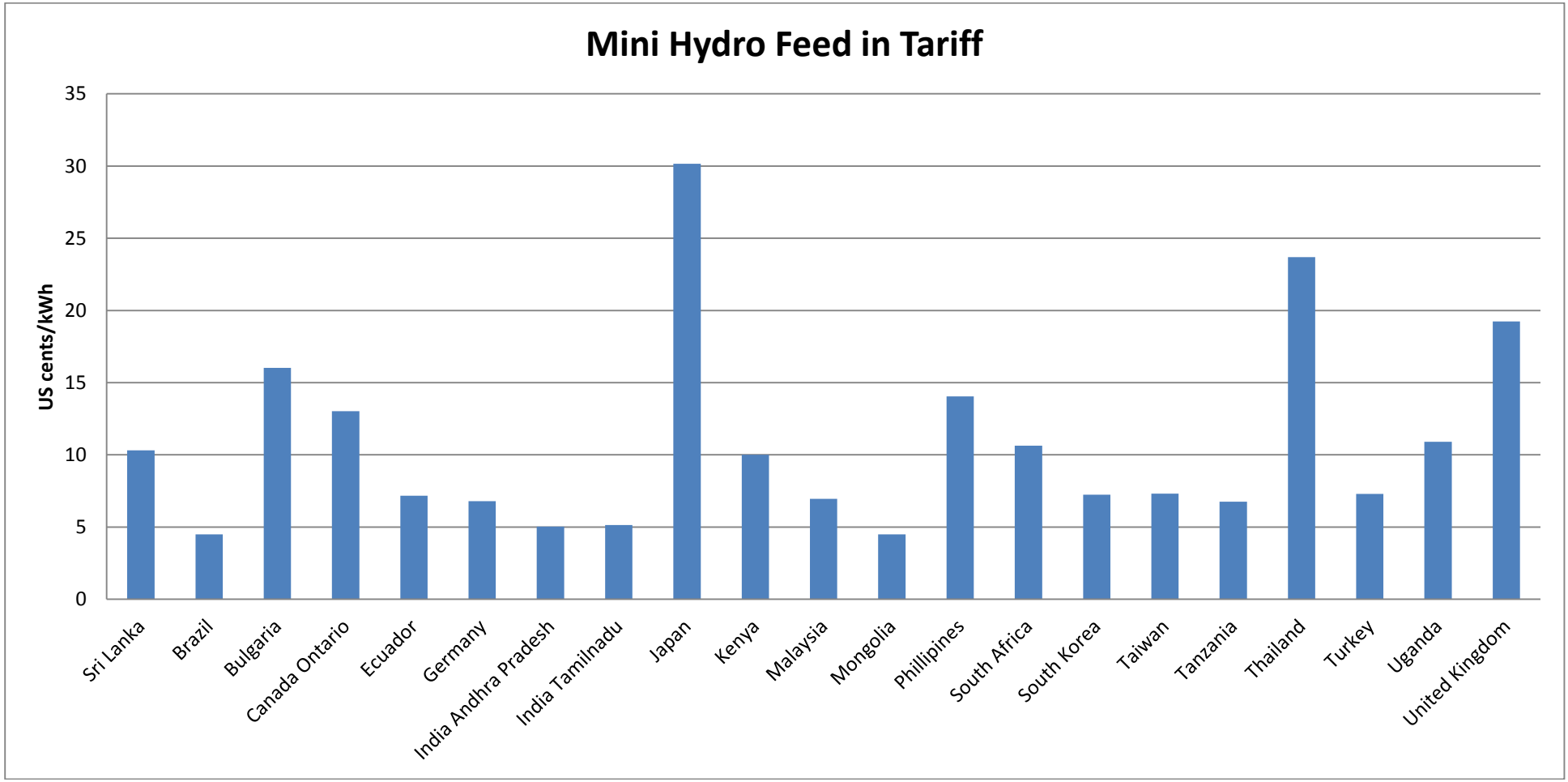


Figure 19.3 Wind Energy Feed in Tariff

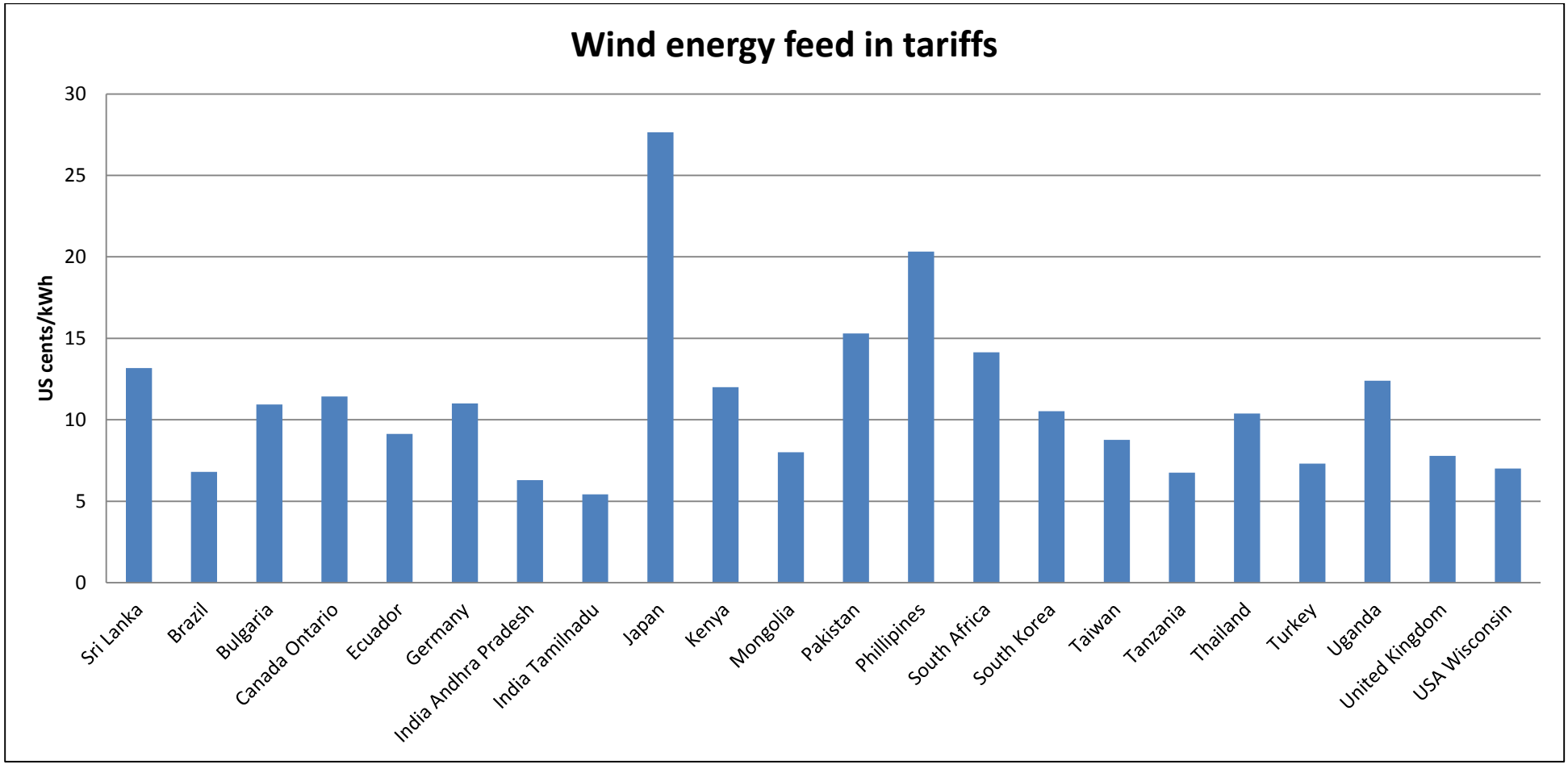


Figure 19.4 Solar PV Feed in Tariffs

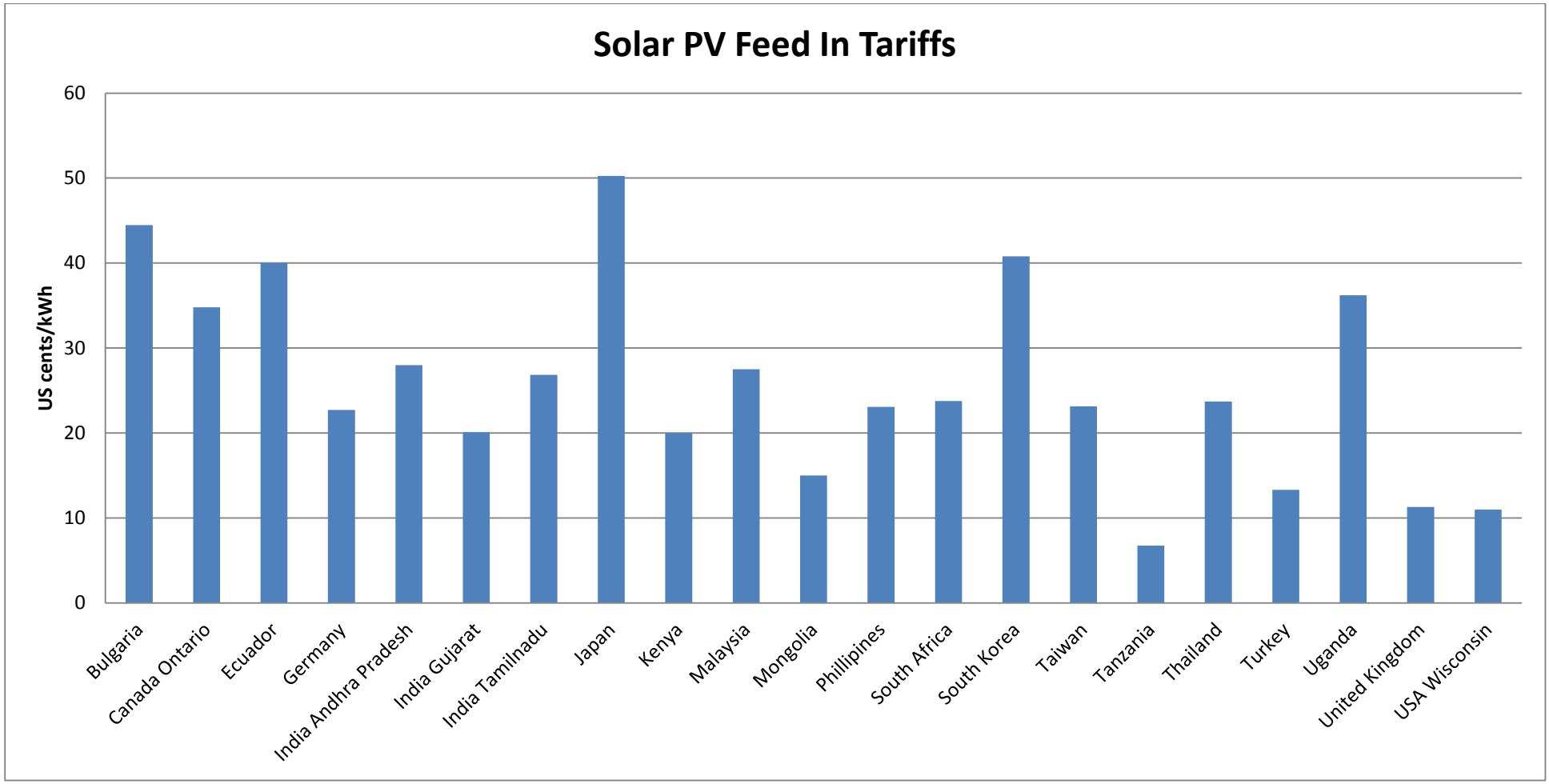


Figure 19.5 Biomass Feed in Tariff

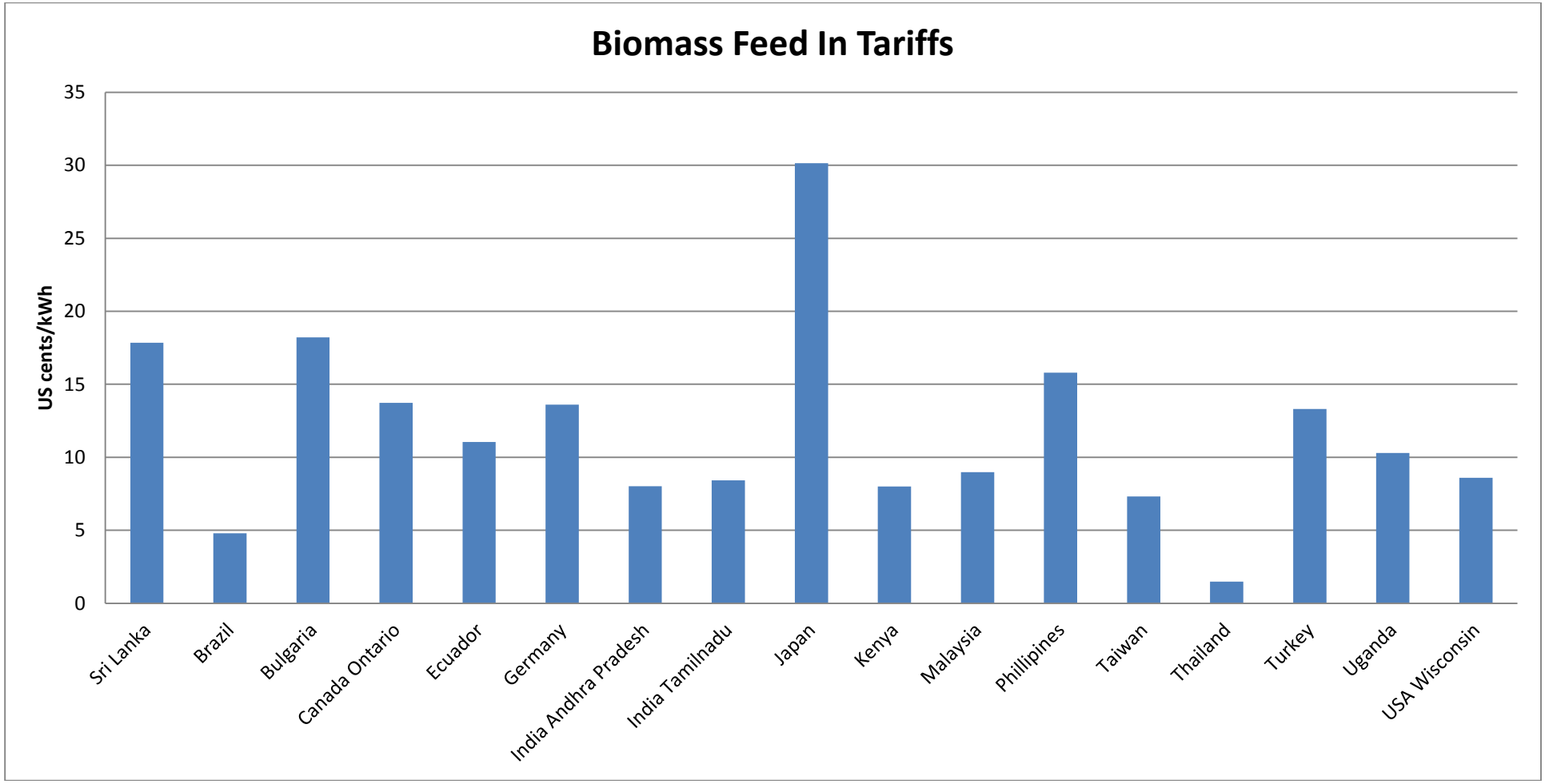


Figure 19.6 Biogas Feed in Tariffs

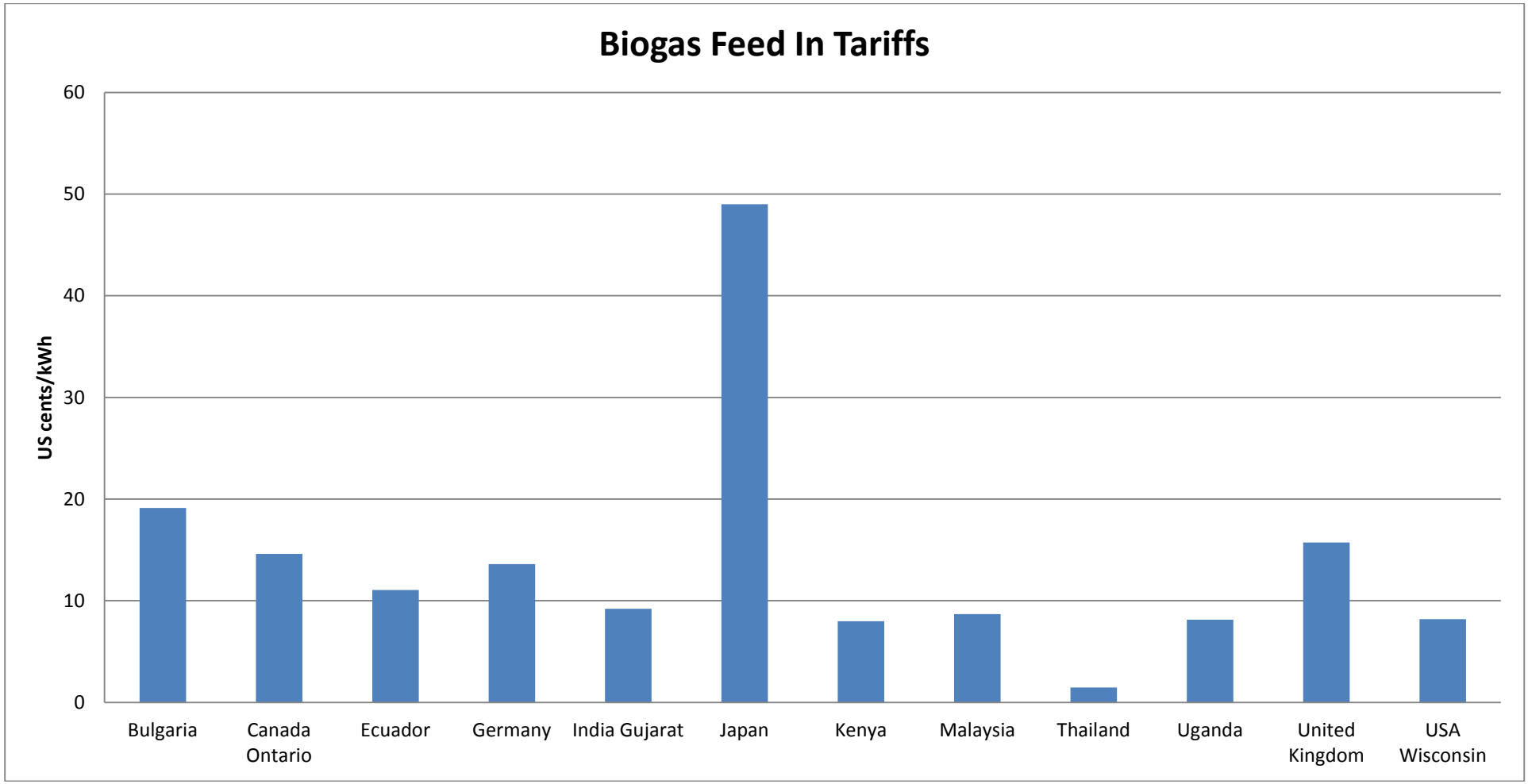
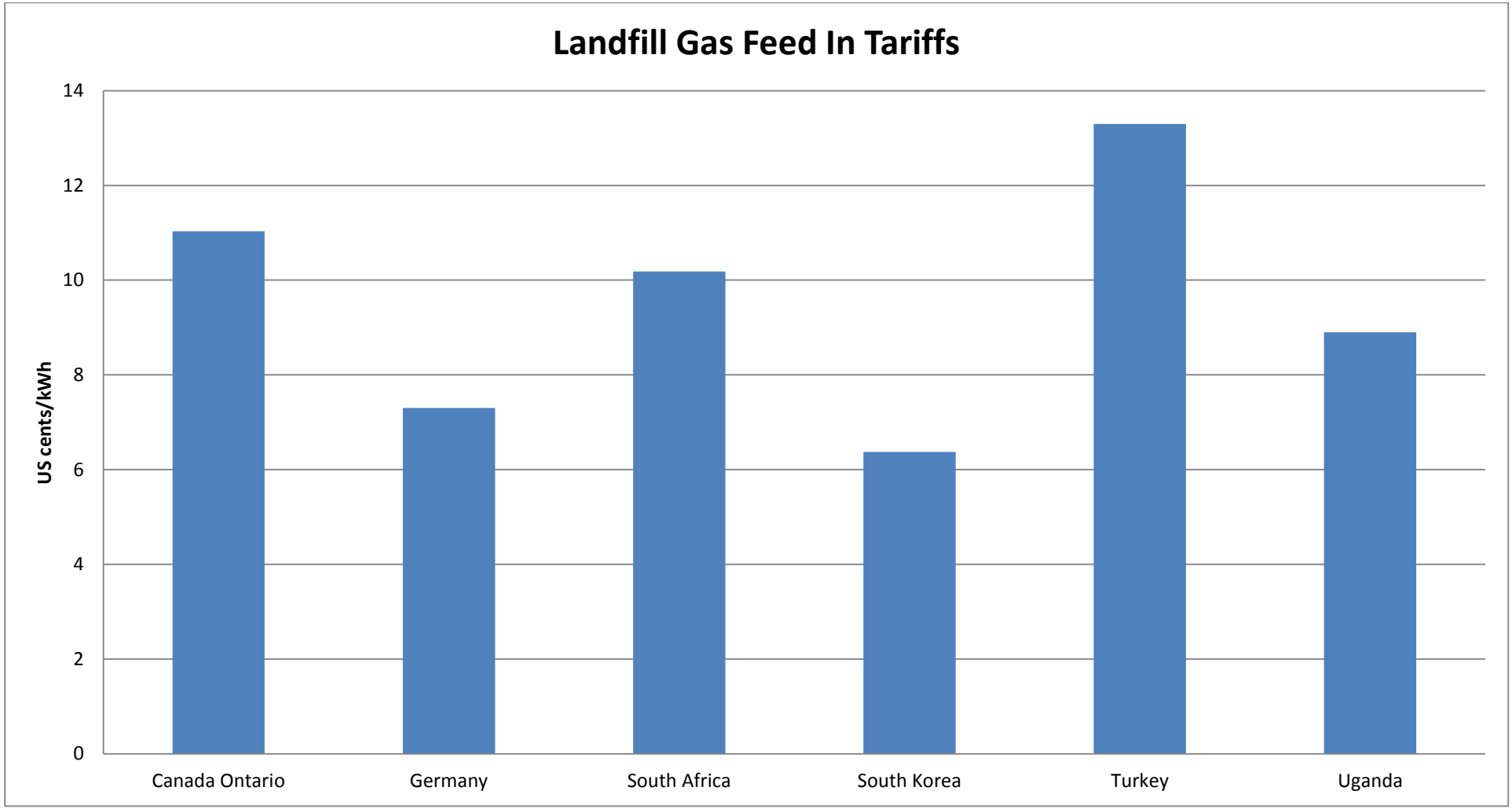


Figure 19.7 Landfill Gas Feed in Tariff



CONCLUSION

In the previous study it was proved that Sri Lanka offered the highest feed in tariff rates for most of the Renewable power generation technologies available. But from the updated analysis, the previous conclusion has been contradicted and it has been now proved that though Sri Lanka offers a reasonably high rate, it still lags behind some of the major competitors in the renewable market.

Sri Lanka offers the largest incentive for renewable energy is through bio mass with an amount of 17.85 US cents per kWh. This gives Sri Lanka the 3rd place from the available statistics. Another fact which had been spotted is that Sri Lanka hasn't given any incentives to implement Solar PV systems. Sri Lanka a tropical country upon the equator gets a large portion of sunlight for an average of 12 hours a day. Therefore a substantially large portion of energy can be utilised. Countries such as Germany and regions such as Gujarat region in India use Solar PV to generate electricity.

A fact which has to be pointed out is that from analysis, Japan has topped almost all Feed in Tariff rates offered for small power providers. From Literature it has been learnt that since the aftermath of the Daichi Fukushima nuclear reactor incident, Japan has opened its eyes to decrease the large risk incurred in operating nuclear power plants. Halting operations of a nuclear power plant will cost a large deficit to the Japanese demand. To bridge this gap, the Japanese government has now promoted Renewable energy projects. Therefore as an incentive the Japanese government had offered a large portion in the Feed in Tariff scheme.

It has been concluded that Sri Lanka has more opportunities to extend its renewable energy generation, in which a more profitable scheme should be developed.

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