

Supportive Policy Framework for Renewable Energy – Experiences for the design of Feed in-Tariff Systems

6 th March 2012, Tokyo

Tariff Setting for the promotion of Renewable Energy – General Approach

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The Renewable Energy Sources Act – Basic principles for tariff setting



Tariff setting based on full costing.

Cost determination based on representative plants which can act as a model for each technology, focussing on the determination of average costs and taking cost ranges into account.

The model assumptions are drawn from a close market observation and the evaluation of realized plants by independent consultants.

Fixed nominal tariff payments over 20 years.

Performance oriented payments (per kilowatt-hour produced).

Yearly cutback of the tariffs for new plants (degression), referring to an evaluation of cost development over time.

Reviewing of the tariffs every three years.





General approach for cost assessment used in Germany



Nominal Levelized Cost of Electricity Generation (LCOE)

LCOE = Annuity of Life Cycle Generation Cost Mean Annual Electricity Generation







Yearly cutback of the tariffs for new plants – an incentive for innovation and cost reduction



Experience curves offer a first indication for setting yearly degression rates





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Tariff Setting for Photovoltaics in Germany

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* Including grid connection, permitting etc.







Investment = Price of the installed photovoltaic system

Example for the investment for a PV plant up to 100 kW in Germany today

Total Investment 1.950 €/kW

Data are collected from

- installer surveys
- published technical reports
- published industry data
- screening of corresponding press releases and news
- scientific surveys and market reports
- the German PV Industry Association
- expert estimates









Nominal Levelized Cost of Electricity Generation (LCOE)

LCOE = $\frac{\text{Annuity of Life Cycle Generation Cost}}{\text{Mean Annual Electricity Generation}}$ $Annuity = \sum_{t=0}^{T} (I_t + OM_t) (1 + r)^t \cdot \frac{r \cdot (1 + r)^T}{(1 + r)^T - 1}$

Weighted interest rate = 5%

equity : debt = 15 : 85 (varying between 20:80 for large ground mounted systems and 10:90 or even 100% debt for small roof top installations)

interest rate for debt capital = 4% interest rate for equity capital = between 9% and 14%









- Costs for operations and maintenance (O&M) are calculated as a share of the initial systems costs (investment).
- O&M costs are estimated as 1,5 % of the total investment per year (1 % O&M + 0,5 % miscellanous (insurance, leasing))
- For large scale systems > 1 MW labour costs are added to O&M costs (> 1 MW: 8.000 € per year; > 20 MW: 20.000 € per year).
- The availability of long-term data on O&M cost is limited.
- As the determination method leads to the *nominal* levelized cost of electricity generation (LCOE) O&M cost has to be adjusted to the inflation rate (2% per year).









The remuneration rate is set to cover all cost for an average installation! The PV power production shall be feasible without any other subsidy! In this case 23,0 ct/kWh would be a possible rate!



Yearly cutback of the tariffs for new plants – an incentive for innovation and cost reduction





Sources: QC Research, PHOTON, EPIA, NREL, Solarbuzz, Strategies Unlimited, P. Maycock





Influence of bottlenecks and oversupplies along the value chain in Germany



2006:

module shortage due to
limited production capacities
→ high profit margins for
module suppliers

2009 (second half): shortage of **mounting manpower** and capacity → high profit margins for installers

2010:

inverter shortage due to lacking supplies of prefabricated parts → high profit margins for inverter suppliers

$\bigcup_{i=1}^{n}$

time



2008:

growing **silicon** demand led to spot market prices which were 3 times higher than in $2007 \rightarrow$ high profit margins for silicon suppliers Since 2009: module supplies grow faster than demand

→ rapid decline in module prices



Sources: QC Research, PHOTON, EPIA, NREL, Solarbuzz, Strategies Unlimited, P. Maycock



Production

Capacity 2004

capacity 2004

Cell

Production

Capacity 2004



- 19 -

< 100 MW







The Photovoltaic world market has grown by more than 10 fold between 2004 and 2010. The turn over rose to 70 billion US\$. In 2010 a photovoltaic capacity equal to 18 nuclear power plants (18.300 MW) has been build!











Lessons learnt – recommendations for Japan



Tariff setting based on full costing makes the investment attractive.
Fixed tariff payments over a long time period offer certainty for investors.
Monitoring of the market development and periodic reviewing of the tariffs are crucial.
Start out with a transparent tariff system which is easily understood.
Introduce a yearly cutback but do not link it to capacity expansion (keep certainty for investors).

