



## Solar-Reports:

- ▶ [Photovoltaic investments outside Germany? Looking into the southern EU states](#)
- ▶ [Solar power from the desert rather than desert in Germany](#)
- ▶ [New Study: Renewable Energy can replace abandoned Nuclear Energy in Germany](#)
- ▶ [BBC Interview with Dr. Knies \(TREC\): The energy source of the future is solar](#)
- ▶ [Photovoltaic industry achieves record profits, discussion over high module prices continues](#)
- ▶ [Chinese solar modules penetrating the German market](#)
- ▶ [Solar Roof Tile Exhibition shows developments in photovoltaic roofing](#)
- ▶ [Intersolar 2006: Solar technology and demand at an all-time high](#)
- ▶ [New Photovoltaic Factories and Capacities in Germany](#)
- ▶ [Renewable Energy in Australia](#)
- ▶ [Cooling with Solar Heat: Growing Interest in Solar Air Conditioning](#)

## Solar Magazine

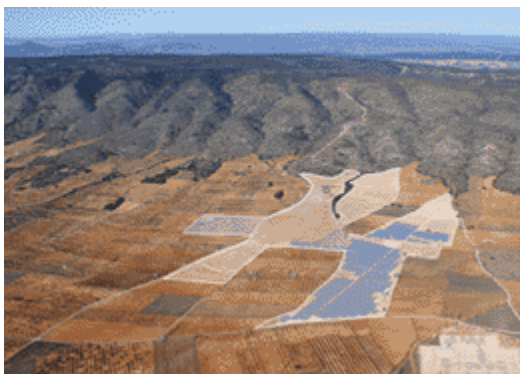
- ▶ [Solar Report](#)
- ▶ [Solar News](#)
- ▶ [Solar News Archive](#)
- ▶ [Solar Links](#)
- ▶ [Solar Energy System of the Month](#)
- ▶ [Your Suggestion](#)

## Photovoltaic investments outside Germany? Looking into the southern EU states

by Rainer Weng  
23 April 2007

The renewable energy law that came into effect in Germany in 2004 was followed by a true boom in photovoltaics. Other European states and countries worldwide took this law that promotes the generation of electricity from solar energy as an example and passed similar laws. These countries too are now undergoing developments that can be compared with the quick growth of solar power systems in Germany since 2004. In Germany, decreasing feed-in tariffs for solar power that is supplied to the network have led to many investors considering investments in photovoltaics in other EU states to maintain their good returns from solar power systems. Some foreign feed-in tariffs are now higher than those of the German renewable energy law. In addition, the significantly higher number of sunshine hours in mediterranean countries are being expected to lead to higher yields.



Solar power plants under the Spanish sun: PV project Beneixama; Photovoltaic modules in Almendricos solar park. Photos: City Solar AG (left); Sunways AG (right)

### Attractive feed-in tariffs in the south of Europe

Current solar power remuneration in France, the solar energy supporting law "Conto



Energia" that was adopted in February 2007 at the Conference of States and Regions in Italy, as well as the utilisation of renewable energy law that came into effect on 25.08.2006 in Greece provide compensation for electricity generated from photovoltaic plants, some of which are higher than German feed-in tariffs according to the German renewable energy law. In Spain, the Ministry of Industry, Tourism and Trade presented the probably final draft of the new feed-in law on 26 March 2007. This law provides a feed-in tariff of 44 eurocents/kWh for the first 25 years of operation for photovoltaic plants of a nominal output of 100 kW that feed electricity into the network. For large-scale PV plants remuneration of 42 cents/kWh is planned. The tariffs are linked to the inflation index.

By taking a 100 kW solar power plant in France, Italy, Spain and Greece respectively as an example, this Solar Report investigates the conditions for financial investments in these countries and shows that on the grounds of favourable framework conditions good returns can be achieved.

## Developments in Germany rise interest in solar power alternatives abroad

At the beginning of 2004 the German demand for photovoltaic systems grew with unprecedented dynamics.



Photo: solar power system on the roof of an agricultural business in Allgäu. Source: Solarserver.de (rh)

A considerable number of the solar modules produced worldwide were sold on the German market that reacted swiftly: demand significantly exceeded supply which rapidly led to a steep increase in prices. Whereas high-quality solar power systems could be purchased for 3,800 euro per kilowatt of installed peak performance (kWp) at the beginning of 2004, even less convincing systems had to be acquired for 5,000 euro/kWp at the end of 2004. Investors' margins shrunk from very high levels to still acceptable profit margins.

## Increasing prices and decreasing feed-in tariffs slowed down investors in Germany

The annual decrease of solar power feed-in tariffs (degression) of 5 % (and 6.5 % for open-space systems from 2006) prescribed by the renewable energy law, together with the high price levels led to decreasing returns. In November 2006 the solar power magazine PHOTON still advised those interested in solar power plants to wait with their purchase because of the high prices for photovoltaic systems. And those who now purchase their turn-key system in 2007 should not be paying more than 3 900 euro, because the feed-in tariffs for new systems would then be 5 % lower. "In some instances the prices still need to drop by 30 % in order for solar systems to yield good returns again for the operator," says Photon Chief Editor Anne Kreuzmann. In the meantime a regulated market has started developing again that shows balanced price levels determined by supply and demand. Since the beginning of 2007 solar power systems can again be purchased at prices equivalent to those of mid 2004. The degression of feed-in tariffs, however, does no longer allow for large financial investments and requires thorough testing of site factors (sun radiation) in order to run profitable systems. The following graphic presentation shows the development of feed-in tariffs:

Ads by Google

### 聞けば人生が変わる

欧米のビジネスマンが、  
っそり使う 成功のキッ  
カケはココでつかめ

[www.febe.jp](http://www.febe.jp)

### 投資・事業用家なら

リクルートが運営する1  
宅情報ナビ。投資と事  
業のための不動産情報  
載

[www.jj-navi.com](http://www.jj-navi.com)

### ビジネスサポートオフ ス

ISO横浜で独立月額  
73500円から 開業する  
ら横浜で

[www.iso-hama.co.jp](http://www.iso-hama.co.jp)

### 5分でできる職務経歴書

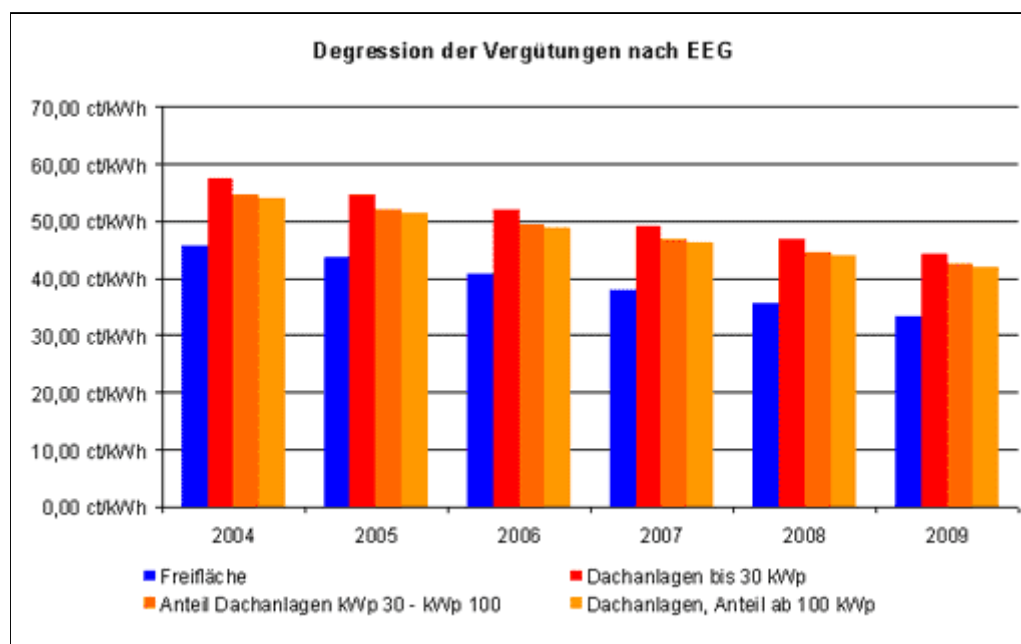
簡単登録で履歴書も職  
経歴書もダウンロード  
できる。無料。

[www.shigotnavi.co.jp/](http://www.shigotnavi.co.jp/)

### ポッドキャストを探す ら

25カテゴリーとオスス  
番組を紹介 ポッドキャ  
スト専門ポータル

[www.podcastnavi.com](http://www.podcastnavi.com)



[Wording of graph: Degression of feed-in tariffs as per renewable energy law; Open-space; Roof systems up to 30 kWp; Partial roof systems 30 kWp – 100 kWp; Roof systems from 100 kWp]

### Comparison of possible solar power returns in different EU states

With feed-in tariffs on the decrease, many ask themselves whether an investment in solar power in Germany is still worthwhile or whether it is wiser to turn to other EU states. The conditions in these countries of interest are compared below.

A standardised 100 kWp system serves as a basis for this comparison of countries. Electricity yields and investment costs are considered to be variable, all other costs were taken to be constant in the respective countries:

- On the side of financing, 20 % equity capital were assumed; 80 % loan capital are calculated with a bank loan in the form of a credit to be repaid in instalments over a period of 20 years with one year grace period. Interest rates were assumed to be 4.5 % for the first 10 years and 5.0 % for a further 10 years.
- Insurances, maintenance contracts and laybacks for repairs were set at 15 EUR/kWp and annum.
- Fixed costs were taken to amount to 300 EUR counter fees and 500 EUR administration costs.
- It was assumed that running costs are subject to an inflation rate of 1.5 %.
- The annual decrease of returns on the grounds of decreasing module performance (degradation) was taken to be 0.4 %. A model plant is to be commissioned in September 2007.

These parameters certainly only constitute rough estimates that will have to be adapted to the various countries. However, for an initial comparison, it is crucial that the external parameters be constant. In order to maintain a certain degree of transparency in the jungle of figures, the main focus point was the overall capital return, i.e. the return of one system before financing and taxation.

#### Germany as a basis, a brief overview

In Germany a 100 kWp system will generate feed-in tariffs of 37,96 ct for open-space systems and 47,54 ct for roof systems if the solar system is connected to the network in 2007. Depending on the return potential of the location and fair investment costs, overall

capital returns of between 5 and 8 % can be attained.

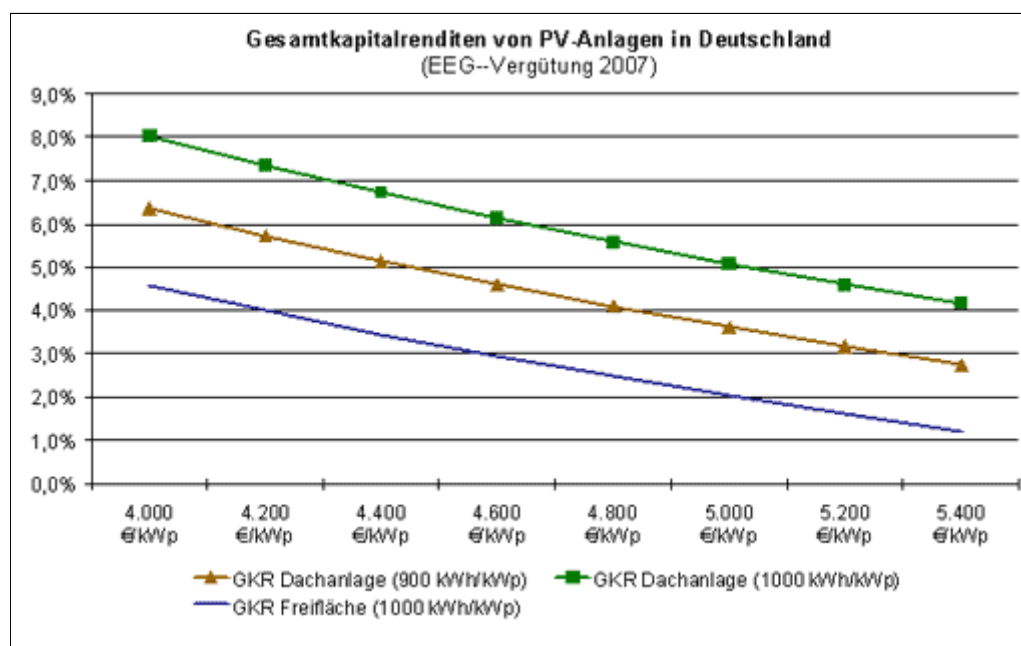


Fig. 2 Overall capital returns of PV systems in Germany (as per feed-in tariffs stipulated by renewable energy law 2007); Overall capital return of roof system (900 kWh/kWp); Overall capital return of roof system (100 kWh/kWp); Overall capital return of open-space system (1000 kWh/kWp)

If only 20 % equity capital are assumed and if the remainder is financed as described above, the loan capital interest rates that lie below the overall capital return allow equity capital returns of between 10 and 15 %. Particularly in low-yield locations, however, not everybody considers these returns to be lucrative. Thus a look into other countries as the future photovoltaics market is sensible.

## Parameters for PV activities in other states

Photovoltaics investors that are looking to become active outside Germany's borders often consider the south. More hours of sunshine obviously promise higher returns per installed unit in the southern EU states. And that the sun of the south is strong, will be confirmed by most Germans that spent their holidays there. Besides the advantages of high electricity outputs and good feed-in tariffs, a few aspects need to be considered critically:

- Obtaining the official approval for solar power plants in foreign locations is not always easy and especially time-consuming; authorities often have other opinions than investors.
- Financing schemes outside the EU are viewed more critically by German banks; financing applications lodged with local banks often fail because of higher interest rates.
- For maintenance and servicing a reliable partner in the respective country is essential, particularly, if you act "only" in the capacity of foreign investor.
- Legal requirements regarding taxes, insurances, liability etc. are not always known to clients that are willing to invest.
- The quality of modules, assembly and/or all other components and assembly parts should be of particularly high standard in "foreign" plants.

If these parameters are met by the specifications and objectives of the investor, projects can be implemented according to his requests, provided your own profitability goals are achieved and a suitable financing plan can be found for the plant. It is essential to present a convincing project-specific feasibility study.

Below the returns for identical model plants in different locations in France, Italy, Spain and

Greece are calculated. Interest in calculations of solar power plants is growing: besides requests from old EU member states, an increased demand for feasibility studies is noted from new EU members, such as Bulgaria. Investors who do not have the possibility of conducting in-depth studies of the situation in the respective countries should, however, rather concentrate on markets in which reference projects have already been implemented by German investors.

### France: possible solar power harvest of 1 100 kWh/kWp in top spots

Compensation for solar power is guaranteed for 20 years and amounts to 30 cents/kWh or 40 cents/kWh in French regions abroad. When systems are integrated into buildings, compensation increases to 55 cents/kWh. Feed-in of over 1 500 peak-load hours (1 800 for regions abroad) per annum are rewarded with further compensation of up to 5 cents.

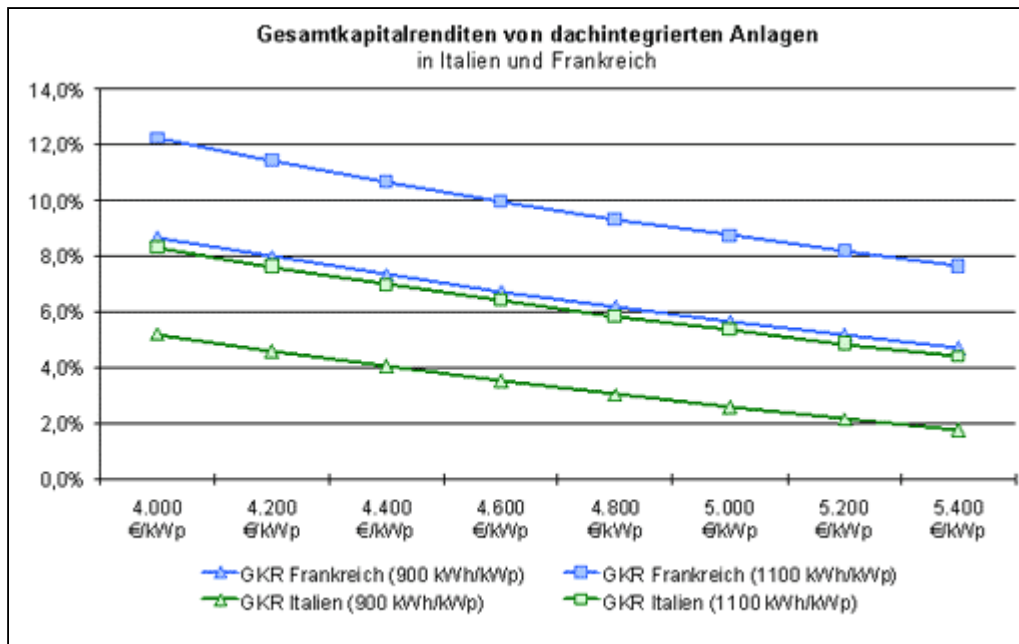
Basic compensation of 30 cents is of little interest when considering current building costs of solar power plants that amount to over 4 000 EUR/kWp. However, systems integrated into existing buildings promise acceptable returns. The costs of integrating a system into a building are generally higher than for classical roof systems, but a compensation of 55 cents/kWh is definitely lucrative. A slightly lower degree of efficiency should be anticipated because heat build-ups can easily result. Our exemplary calculations showed two types of returns: in top locations a solar harvest of 1 100 kWh per installed kilowatt of peak performance per annum, and in other locations expected yields that correspond to those in Germany (900 kWh/kWp).



Overall capital returns (French plants indicated in blue in graphic presentation below) of over 10 % seem to be realistic in good locations.

150 kWp SunTechnics solar power plant at the bus terminal Clermont-Ferrand (Auvergne; France) with solar modules installed on the roof and as sun façade.  
Photo: Conergy AG

Even in less favourable locations, higher loan financing shares can still lead to 15-25 % equity capital interest yields if an overall capital return of over 8 % can be attained. On the grounds of property regulations, however, systems integrated into existing buildings are generally not possible for investors from abroad. Conventional roof systems or open-space systems are more readily separable from immovable property and are thus the preferred investment object of foreign PV investors.



Overall capital returns of roof-integrated systems in Italy and France; Overall capital return France (900 kWh/kWp); Overall capital return France (1100 kWh/kWp); Overall capital return Italy (900 kWh/kWp); Overall capital return Italy (1100 kWh/kWp)

### Italy: relatively low compensation for open-space plants compensated by high number of sunshine hours

For plants integrated into buildings, similar parameters can be assumed as in France. However, the returns are lower because of feed-in tariffs of 44 - 49 ct/kWh where 55 ct/kWh are being paid in France. Fully integrated systems of up to 20 kWp receive an incentive of 49 eurocents per kilowatt-hour. For solar power from fully integrated systems with an output of over 20 kWp, 44 eurocents per kWh are paid. Open-space plants of over 20 kWp will in future receive the lowest incentive of 36 eurocents. Feed-in tariffs are guaranteed for 20 years in Italy. In 2009 the Ministry for Economic Development and the Environment will reconsider the tariffs.



Assembly of solar modules of a solar power plant in southern Tyrol. With a peak performance of 520 kWp this is one of the largest photovoltaic systems in the emerging Italian solar market.

Photo: juwi solar GmbH

In spite of relatively low compensation, open-space plants can be interesting if the right location is selected and the high number of hours of sunshine compensates the lower feed-in tariffs. However, it seems difficult to exceed overall capital returns of over 7 %.

Investitionen in italienische Freiflächenanlagen Renditen bei einer Vergütung von 36 ct/kWh								
Baukosten	4.000 €/kWp	4.200 €/kWp	4.400 €/kWp	4.600 €/kWp	4.800 €/kWp	5.000 €/kWp	5.200 €/kWp	5.400 €/kWp
<b>Stromerträge von 1.100 kWh/kWp</b>								
Gesamtkapitalrendite	5,2%	4,6%	4,0%	3,5%	3,0%			
Investition	400.000 €	420.000 €	440.000 €	460.000 €	480.000 €			
Eigenkapital 20%	80.000 €	84.000 €	88.000 €	92.000 €	96.000 €			
Eigenkapitalrendite	6,2%	4,1%	2,1%	0,2%	-1,8%			
Rückfluss vor Steuern	178.704 €	152.260 €	125.816 €	98.634 €	68.024 €			
Überschuss nach Abzug EK	98.704 €	68.260 €	37.816 €	6.634 €	-27.976 €			
<b>Stromerträge von 1.300 kWh/kWp</b>								
Gesamtkapitalrendite	7,8%	7,1%	6,5%	5,9%	5,4%	4,9%	4,4%	3,9%
Investition	400.000 €	420.000 €	440.000 €	460.000 €	480.000 €	500.000 €	520.000 €	540.000 €
Eigenkapital 20%	80.000 €	84.000 €	88.000 €	92.000 €	96.000 €	100.000 €	104.000 €	108.000 €
Eigenkapitalrendite	15,3%	12,9%	10,7%	8,6%	6,7%	5,0%	3,3%	1,8%
Rückfluss vor Steuern	332.527 €	306.082 €	279.638 €	253.194 €	226.750 €	200.305 €	173.862 €	147.412 €
Überschuss nach Abzug EK	252.527 €	222.082 €	191.638 €	161.194 €	130.750 €	100.305 €	69.862 €	39.412 €

Fig. 4: Investments in Italian open-space plants. Returns at a feed-in tariff of 36 ct/kWh. [Wording of table: Building costs; Electricity output of 1 100 kWh/kWp; Overall capital return; Investment; 20 % equity; Return on equity; Reflux before tax; Surplus after deduction of equity; for remainder, see above wording]

For foreign investors other countries thus appear more lucrative. Particularly regarding open-space plants, Spanish and Greek solar power plants were superior to Italian plants in terms of their feasibility.

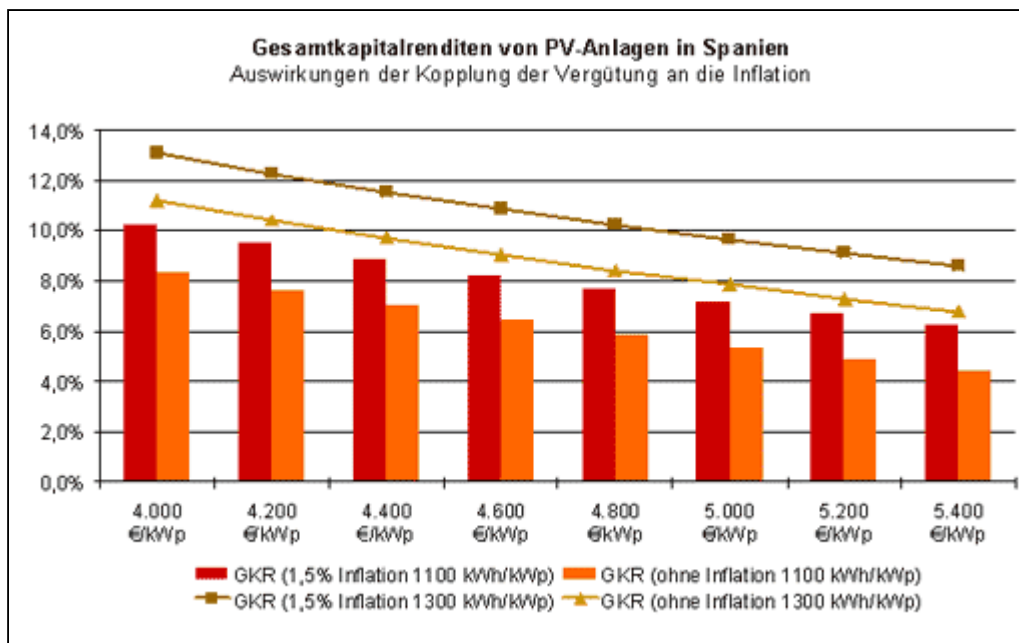
### Spain: feed-in tariffs coupled with the inflation rate promise extra profits

For solar power from PV systems with an output of 100 kWp approx. 44.0 cents/kWh are paid, for systems of between 100 kWp and 10 MW approx. 41.7 cents/kWh, and for systems from 10 MW only about 23.0 cents/kWh. The new set of legislation that is to replace current remuneration according to the "Real Decreto 436/2004" has been extensively discussed and is currently being implemented. Compensation according to this draft legislation lies significantly above current German tariffs for open-space plants and, in addition, the "Sun of Spain" allows far higher electricity outputs per kWp than in Germany. Frequently calculations of plants show a solar power output of over 1 300 kWh/kWp.



SunTechnics façade in Cadiz, Spain; Inverter of the Solar Park Almendricos (Murcia region). Photos: SunTechnics GmbH; Sunways AG.

A great competitive advantage in Spain is the coupling of the feed-in tariffs to an index, i.e. compensation can generally be expected to increase from year to year. Whereas so far the electricity reference price was the basis, compensation will in future be coupled to the inflation rate. The effect of this coupling on returns can be seen from the comparison of two plants (one with 1 100 kWh/kWp and the other with 1 300 kWh/kWp); a price increase of 1.5 % and no inflation were assumed in the calculations.



[Overall capital returns from PV plants in Spain; effects of coupling remuneration to inflation; Overall capital return (1.5 % inflation 1100 kWh/kWp); Overall capital return (no inflation 1100 kWh/kWp); Overall capital return (1.5 % inflation 1300 kWh/kWp); Overall capital return (no inflation 1300 kWh/kWp)]

The result is impressive and the advantages resulting from this coupling become obvious: the inflation approach simply translates into additional profit. With compound interest, this amounts to significant sums. The result is an increase of 2 % in overall capital returns. 1.5 % higher remuneration is reflected in the following figures:

- per kWp per annum approx. 70 – 80 EUR more profit:
- for 100 kW this amounts to an additional profit of 7 000 EUR, excluding compound interest!

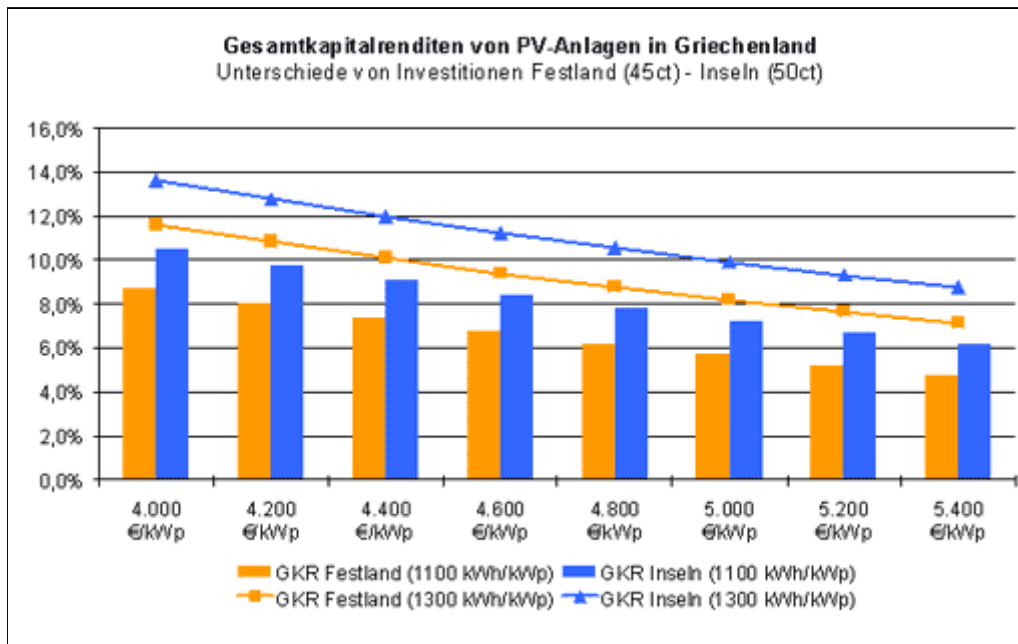
## Greece: peek remuneration for solar power from the islands

The Greek renewable energy law that now also promises better remuneration for solar power in Greece, was passed by the Greek Parliament on 07.06.2006 and came into effect on 25.08.2006. It contains the following tariff system for PV plant operators that have entered into a feed-in contract with a Greek network operator. The legislator draws a distinction between investments on continental Greece and on Greek islands:



Solar power plants in Athens. Source: SCHOTT AG

When considering possible returns, particularly the Greek islands are of interest (50 ct/kWh for plants up to 100 kW; large-scale plants 45 ct/kWh), but also in continental Greece feed-in tariffs of 45 ct/kWh for plants up to 100 kW are very lucrative (large-scale plants 40 ct/kWh). Investments in the 100 kW plant of our example yield the following results:



Overall capital returns of PV plants in Greece; Differences between investments in continental Greece (45 c) and on Greek islands (50 c); Overall capital return Continental Greece (1100 kWh/kWp); Overall capital return Islands (1100 kWh/kWp); Overall capital return Continental Greece (1300 kWh/kWp); Overall capital return Islands (1300 kWh/kWp)

The returns speak for themselves. If plants “only” have an output of 1 100 kWh/kWp, returns of about 8 % can already be achieved. In the event of 80 % loan capital, this correlates with an equity capital interest of over 15 %. Calculations done for good locations that achieve an output of 1 300 kWh/kWp show that overall capital returns of over 10 % can be obtained. This means an equity capital interest of about 20 – 25 %.

### Conclusion: individual calculations crucial

Country-specific regulations, such as coupling solar power remuneration to the inflation rate, can be sensible parameters to effectively promote photovoltaics. Such an approach could also serve as an example for the imminent revision of the renewable energy law in Germany. By spreading the remuneration across all electricity consumers, a plant that has been installed would cost consumers not a single cent more even when compensating inflation, because network contributions as well as the actual electricity price are also subject to continuous price increases.

Calculations done for an exemplary plant of 100 kW in the four EU countries selected show that it is possible to achieve good returns. Individual calculations that take into consideration the exact location, costs, financing and type of plant will lead to a further optimisation of feasibility. It will become clear that an investment decision that takes into consideration the precise situation can mean an additional few thousand euros in your pocket. However, it must be ensured that the framework conditions are suitable – in investments in EU states many factors play a role. The business-economic selection of a country is one of the central criteria, but whether or not expectations will be met largely depends on the location, the official approval, maintenance and quality of the plant.

An exemplary feasibility calculation can be done with the free demo version of PV-Kalk at <http://www.solarserver.de/service/dimensionierung.html#pvkalk>. For further information go to <http://www.rw-c.de>. PV-Kalk can be purchased from SolarserverStore at <http://www.solarserver.de/store/front/produkt.php?produkt=866>

Authors: Dipl.-Kfm. Rainer Weng; RWC Wirtschaftsberatung, Würzburger Straße 4; 86720 Nördlingen; Tel. 09081 / 290 26 72; e-mail: [info@rw-c.de](mailto:info@rw-c.de). Rolf Hug, Editor of Solarserver:

info@solarserver.de

## Additional Solar-Reports:

- ▶ [Building Solar: The Prospects and Costs of Living with the Sun](#)
- ▶ [Fuel Cell Research and Development in Southern Germany](#)
- ▶ [The Photovoltaic Market in Japan: Unquestioned Leadership of World Market](#)
- ▶ [The National Energy Plan](#)
- ▶ [Trade Fair Intersolar 2001 Presents World Wide Solar Technology for the First Time](#)
- ▶ [Solar Thermal Technologies in the United States](#)
- ▶ [An Overview of Photovoltaics in the USA](#)
- ▶ [The Year 2000: Breakthrough for Solar Technology in Germany](#)
- ▶ [Fuel Cells and Solar Hydrogen-A Power Package for the Future?](#)



amazon.com<sup>®</sup>  
and you're done.<sup>™</sup>

	<a href="#">Wind and Solar Power Sys...</a> Mukund R. Patel New \$132.95! Best \$94.95!		<a href="#">Got Sun? Go Solar</a> Rex A. Ewing New \$12.89! Best \$12.25!
	<a href="#">The Easy Guide to Solar ...</a> Pieper Adi New \$13.57! Best \$7.55!		<a href="#">2007 Solar Energy</a> U.S. Government New \$25.00! Best \$25.00!
	<a href="#">Photovoltaic Systems Eng...</a> Roger A. Messenger... New \$83.96! Best \$72.03!		<a href="#">Photovoltaics Design And...</a> "Solar Energy Inte... New \$37.77! Best \$37.24!

(Prices may change) Privacy Information

[Banner Advertising](#) | [Bulletin Board](#) | [Events](#) | [Solar Magazine](#) | [Funding for Solar Energy](#) | [Companies](#) | [Solarstore \(G\)](#)  
[Profit Organizations](#) | [Lexicon](#) | [Basic Knowledge](#) | [Educational Institutions](#) | [Imprint](#) | [Contact Us](#) | [Home](#)

[up](#)

Last modified: 05/03/2007 13:48:17

**[Webdesign Heindl Internet AG](#)**