

# GLOBAL INSTALLED PHOTOVOLTAIC CAPACITY AND IDENTIFICATION OF HIDDEN GROWTH MARKETS

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## ABSTRACT

The installed capacity of photovoltaic (PV) is rising steadily. Most PV is installed in highly electrified countries as on-grid systems. Further, there are reams of small off-grid systems in rural areas of developing countries. Due to this, reliable installation rates for PV are available only for a small number of countries. For the end of 2013 EPIA reports 138,858 MWp of installed PV capacity, using data for 45 countries, whereas 2,098 MWp are not allocatable to specific countries. IEA-PVPS gives a number of 136,200 MWp installed by providing detailed data for 32 countries, 24 of which coming from official sources in IEA PVPS member countries.

This paper gives an overview of installed PV for all countries in the world, being predicated based on the examination of publically accessible data. Furthermore, an analysis of the development of cumulative PV capacities in recent years is given. Resulting from this evaluation, PV installations are localized in 191 countries, representing 137,500 MWp.

## Keywords

PV Markets, Installed Capacity, PV Installation, Market Growth

## 1 MOTIVATION

The global photovoltaic (PV) market is the fastest growing of all renewable energy markets [1]. However, many successful countries, as measured by their renewable energy investments per gross domestic product, are typically not known. Public reports do not usually show any data for installed capacities in small PV markets. These markets are usually named as Rest of World (RoW). However, they often show a constant growth of installed PV capacity. Furthermore, in a significant number of those small markets, a rapidly rising growth rate is identifiable. With rising photovoltaic capacities and growing economies in these markets, they have a potential to become important photovoltaic markets in the future. Thus, RoW markets have to be better understood.

As a result, an analysis of cumulative installed PV capacity for all countries in the world is strongly required. This paper gives an analysis of photovoltaic capacities and growth rates ranging from 2009 to today for every market. Further data starting in 2001 are available, but would exceed the scope of this paper. On this basis, estimation of future growth rates and PV capacities expected to be installed in all markets can be performed.

## 2 EXAMINATION METHOD

European Photovoltaic Industry Association (EPIA) provides an estimate of 2,098 MWp capacity [2] for countries which are commonly named as Rest-of-World (RoW). However, for these RoW countries no reliable estimation of installed PV is available because a considerable part is represented by off-grid systems. There is also a lack in public authority monitoring, and respective markets are too small for international monitoring. To enhance a reliable valuation of the

photovoltaic markets of developing countries, the examination of several sources is necessary to ensure a credible estimation.

A basic source is the international customs database, monitored by the 'Market Analysis and Research' section of the International Trade Centre, which is an agency of UN's World Trade Organization. This database contains the customs data of all countries worldwide since the year 2000, receiving the data from the particular national customs authorities. The database provides the opportunity to evaluate the total value of imported and exported products for each country per year. Furthermore, a possibility of evaluating bilateral trades for a specific product is given. Products are classified in several specific product numbers, so-called HS Codes, being obligated by more than 200 countries, customs and economic unions, representing more than 98% of world's trade [3]. HS Code group 854140 represents 'photosensitive semiconductor devices, photovoltaic cells and light emitting diodes'. More specific descriptions with detailed determination of codes between light emitting diodes and PV are available for approximately 95% of the data. Otherwise, an experienced ratio of 80% PV and 20% light emitting diodes is used. Surprisingly, a large number of developing countries' customs agencies have reported detailed data. It is valid that: '*imports A from B*' = '*exports B to A*'. Data have been assigned for 190 countries in a period of 2000 until 2013. The basis of the calculation of PV capacities per country is the following assumption: '*import A*' - '*exports A*' + '*production A*' = '*market A*'. The production volumes refer to the publications of the magazine 'Photon' on the topic of production output [4]. From this, attention is paid to the fact that approximately 25% of annual production will be installed in the following year.

Since data include the monetary value of the products, a conversion to PV capacities is necessary. For this purpose a reliable estimation of PV prices per Wp for

every country is needed. These price data refer to a worldwide annual average PV module price per Wp [5, 6]. Since prices depend on countries' locations and market sizes, there is a great ratio of divergence. Therefore, all countries are classified in five main groups with one of them having two subgroups, each representing a group of countries that are nearly comparable in market size and economic conditions. The world's average price is multiplied by a factor quoting the ratio of countries' prices for each of these groups. The ratio is based on experience and statements of several countries' experts that have been contacted [7-11] and has been validated in previous publications [12, 13, 14]. Since the world's given average annual PV prices are selling prices of modules' producers, a factor of 10% is added considering distributor margins, shipping, etc. Therewith, prices for the year 2013 diverge between 0.80 USD/Wp (0.59 EUR/Wp) for advanced PV market

countries and 1.96 USD/Wp for small PV applications in African and Asian low-income countries as can be seen in Table 1.

To lower the probability of error, further sources with installation rates estimated by EPIA, International Energy Agency Photovoltaic Power Systems Programme (IEA-PVPS), journal du photovoltaïque, the European Commission and Hanwha Q.CELLS market research are used [2, 15-23]. Some countries report PV installation data by giving DC capacities while others refer to their installed AC capacities. Thus a small probability of mismatch between report data and those number calculated by using the DC capacity by the customs data base is possible.

**Table 1:** PV price for conversion of customs values into PV [5, 6]. Abbreviations: North America (NA) and Latin America (LA).

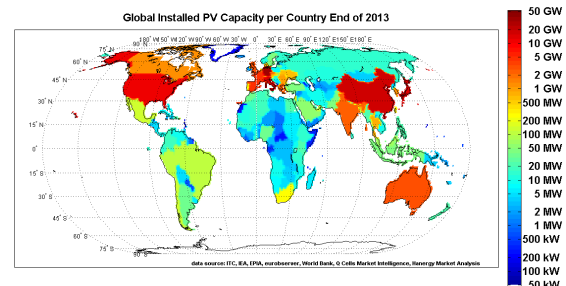
[\$/Wp]	year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
<i>average world price:</i>	100%	5.17	4.96	4.36	4.13	4.24	4.55	5.07	4.57	4.38	2.53	2.05	1.65	1.21	0.89
<b>countries &gt;100MW/y</b>	90%	4.66	4.47	3.92	3.72	3.82	4.09	4.56	4.11	3.94	2.28	1.85	1.49	1.09	0.80
<b>countries &gt;10MW/y</b>	110%	5.69	5.46	4.79	4.55	4.67	5.00	5.57	5.02	4.82	2.78	2.26	1.82	1.33	0.98
<b>countries &gt;5MW/y</b>	150%	7.76	7.44	6.54	6.20	6.36	6.82	7.60	6.85	6.57	3.79	3.08	2.48	1.82	1.34
<b>countries &lt;5MW/y</b>	180%	9.31	8.93	7.84	7.44	7.63	8.19	9.12	8.22	7.89	4.55	3.70	2.97	2.18	1.60
<b>countries &lt;1MW/y</b>	200%	10.35	9.93	8.71	8.27	8.48	9.10	10.13	9.14	8.76	5.06	4.11	3.30	2.42	1.78
Africa & Asia	220%	11.38	10.92	9.59	9.10	9.33	10.01	11.14	10.05	9.64	5.57	4.52	3.63	2.66	1.96
Europe & NA & LA	190%	9.83	9.43	8.28	7.86	8.06	8.64	9.62	8.68	8.33	4.81	3.90	3.14	2.30	1.69

Beside, all sources are weighted in a certain order. For countries that have their own cell or module production, the arithmetic mean of all sources except customs data is taken for estimation of installation rates, due to production margins and local PV value chain structures influencing the reliability of the customs database. In case of countries having no production, the average of all sources is used.

Due to statistical impacts of additional databases, it is possible in individual cases that estimated installed PV capacities at the end of 2013 can be less than those estimated at the end of previous years.

### 3 OVERVIEW ON PV INSTALLATIONS 2013

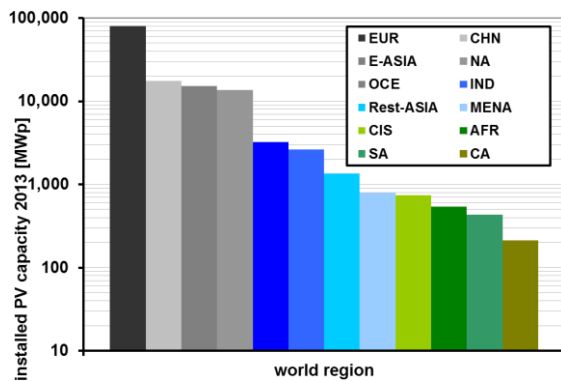
Within the use of this examination, the world's total installed PV capacity is estimated to be up to 137,500 MWp at the end of 2013. It is expected that there are further 487 MWp that had been installed before 2000. PV installations are able to be found in almost all countries. Appendix Table 1 includes the results for PV installation rates for all countries in the world at end of 2013.



**Figure 1:** Total installed PV capacity per country by end of 2013.

As can be seen in Figure 1, Germany is dominating with a share of 26% of total global installed PV. Further, 17 markets claim more than one GWp of PV capacity by end of 2013, which is an additional four markets compared to the end of 2012 (Canada, South Korea, Romania and Bulgaria). Those 17 largest markets, Germany (35,680 MWp), China (18,310 MWp), Italy (17,780 MWp), Japan (13,500 MWp), the United States (12,200 MWp), Spain (5,020 MWp), France (4,690 MWp), the United Kingdom (3,370 MWp), Australia (3,200 MWp), Belgium (2,990 MWp), India (2,610 MWp), Greece (2,570 MWp), Czech Republic (2,140 MWp), South Korea (1,350 MWp), Canada (1,320 MWp), Romania (1,050 MWp) and Bulgaria (1,000 MWp) amount to 94% of global PV installations. Thus, compared to 2012, a small increase of 1% in the share of those gigawatt markets can be identified. Furthermore, there are 19

additional countries claiming more than 100 MWp per country (Thailand, Switzerland, Ukraine, the Netherlands, Austria, Denmark, Slovakia, Israel, Taiwan, Portugal, Slovenia, South Africa, Bangladesh, Chile, Mexico, United Arab Emirates, Brazil, Luxembourg, Peru). However, several other emerging and developing countries show a significant installed PV base, in particular Indonesia (47 MWp), Pakistan (46 MWp), Nigeria (38 MWp), Morocco (37 MWp), Kenya (25 MWp) and many more. In these countries PV installations are mainly realized as off-grid systems, i.e. 5 MWp solar home systems with an average size of 50 Wp represent a solar power solution for 100,000 families [24].



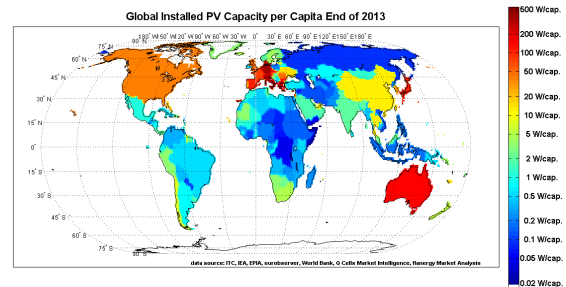
**Figure 2:** Installed PV capacity per world region at the end of 2013.

Figure 2 shows the cumulative installed PV capacity at the end of 2013 for each region of the world. Europe shows the highest PV installation rates, with 80,447 MWp, claiming more than 58% of the world's PV. Even without the dominating German market, Europe would be in the lead. However, especially from 2012 to 2013, the European domination decreased, as at the end of 2012 70% of all PV was installed in European countries. The Chinese (18,312 MWp), East Asian (15,192 MWp) and North American (13,520 MWp) markets are, moreover, those regions representing more than ten GWp of photovoltaic respectively. Further, there are three regions having an installed PV base of more than one GWp per region (Australia and Oceania, Rest of Asia and India). MENA (789 MWp), the former Soviet Union (738 MWp), Africa (537 MWp), South America (433 MWp) and Central America (213 MWp) are markets that show less than one GWp of installed PV.

Approximately 75% of global installed PV capacity (103,191 MWp) is installed in countries that have a gross domestic production (GDP) per capita higher than 30,000 USD per year. Low income countries (GDP/capita <10,000 USD) claim 26,010 MWp in 113 countries. Low income countries have a more than thirty-fold increase in their PV capacity since 2009, which is six times more than high income countries that increased their installed PV capacity only by a factor of five during the same period of time [12]. Countries with a GDP per capita between 30,000 USD and 10,000 USD represent only 7,863 MWp.

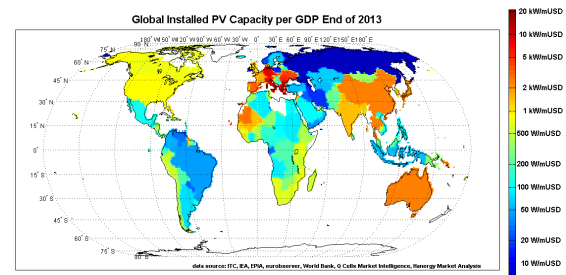
Towards recent years when countries with less than 1,500 kWh/(m<sup>2</sup>·a) represented the highest shares of installed PV, the majority of 58% of total PV at end of 2013 is located in countries with medium irradiation (1,500-

2,000 kWh/(m<sup>2</sup>·a)), whereas in 2012 only 51% was cumulatively represented by these countries [12, 13, 14]. Thus, in 2013 photovoltaic capacity grew especially in these medium regions. Countries having less than 1,500 kWh/(m<sup>2</sup>·a) represent 39% of total installed PV. In those countries predestined to use PV due to their very high insolation (>2,000 kWh/(m<sup>2</sup>·a)), PV is often used as off-grid applications, leading to only 3.2% of global PV being installed there [25].



**Figure 3:** Installed PV capacity per capita by end of 2013. Population data have been taken from the United Nations [26].

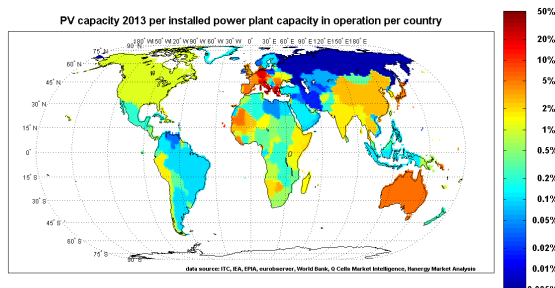
Figure 3 shows the PV installations per capita per country. It is recognizable that a small number of countries claim high rates of PV installations per capita. Germany (431 Wp/capita), Italy (290 Wp/capita), Belgium (268 Wp/capita), Greece (231 Wp/capita), Czech Republic (199 Wp/capita), Luxembourg (196 Wp/capita), Bulgaria (138 Wp/capita), Australia (138 Wp/capita), Slovenia (130 Wp/capita), Spain (107 Wp/capita), Japan (106 Wp/capita), Slovakia (103 Wp/capita) and Denmark (102 Wp/capita) are the ones with more than 100 Wp/capita. Especially, highly developed countries in Europe, North America, East Asia or Australia, with respectively high electricity consumption per capita, show significant rates. Furthermore, island countries show significantly high PV installations per capita. With Malta, Cyprus, Puerto Rico, Cape Verde, Bahamas, Bermuda, New Caledonia, Barbados, Rep. of Palau, Maldives, Kiribati, the Seychelles and Mauritius a respective number of those are able to be found in the top 50 ranking in PV per capita. This might be due to PV being a cost effective energy source that enables those remote island countries to be saved from high prices for conventional electricity generation [27, 28]. As a world average, every human claims 19.3 Wp PV in the statistical view.



**Figure 4:** Global overview on cumulative PV installations per million USD of GDP as of end 2013. Data for GDP have been taken from World Bank [29].

An indicator of how much capital is invested relatively in PV is recognizable in installed PV capacities per

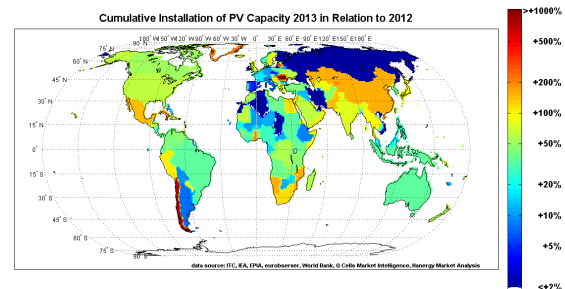
countries' GDP (Figure 4). With the use of this comparative parameter, markets are able to be well compared. Some countries have reached significant ratios of PV installations per one million USD of GDP. One is able to realize Bulgaria as by far the country that relatively invests most of its economic power into PV (18.7 kWp/mUSD) followed by Czech Republic (9.9 kWp/mUSD), even ahead of the German market (9.9 kWp/mUSD). Furthermore, small countries that often are rarely recognized due to having installed only a few MWp can be distinguished. Thus, countries like Cape Verde (5.2 kWp/mUSD), Kiribati (3.1 kWp/mUSD), Mauretania (2.9 kWp/mUSD), Solomon Islands (2.5 kWp/mUSD), Malta (2.4 kWp/mUSD), Luxembourg (1.9 kWp/mUSD), Micronesia (1.6 kWp/mUSD) or Guyana (1.6 kWp/mUSD) invest more of their economic power in PV than the bulk of highly developed countries. In comparison to this, highly developed countries such as the United States (0.8 kWp/mUSD), Poland (0.015 kWp/mUSD), countries of the Arab peninsula or Scandinavia have a vast potential of investing more capital in PV. Especially, typical off-grid PV countries, like the African ones, have realized PV as being able to improve significantly people's living conditions and save enormous financial resources in the mid- to long-term. Due to a fast amortization of PV systems in rural areas of developing countries [24, 30], these markets have no need for subsidies and make off-grid PV countries foremost in proportion of PV expenditures to GDP. Russia, Azerbaijan and Ireland show the lowest investments of their economic power in PV.



**Figure 5:** Global overview of cumulative PV installations as of the end 2013 per total power plant capacity per country for the year 2010. Some countries have already broken the 10%-threshold. Data for total power plant capacity have been taken from Platts, World Electric Power Plants database [31].

As a consequence of high ratios of PV to GDP, various countries have already reached a measurable share of PV in their total power plant capacities (Figure 5). Thus, 21% of Germany's conventional power generation capacity is complemented by PV. In Belgium and Greece 15% of the respective conventional power plant capacity is complemented by PV. Italy (14%), the Czech Republic (13 %) and Cape Verde (11%) claim more than a 10% composition of their total power plant capacity. Especially, European, African and a few Asian countries show high ratios of PV in their power plant capacities. While regarding the African countries that represent high ratios of PV in their power plant capacities closely, it is obvious that they are the ones using a bulk of diesel power plants for generation of electricity. Countries leading in usage of diesel power, due to their remote location like islands or a couple of African countries, are leading in shares of PV in their total power plant

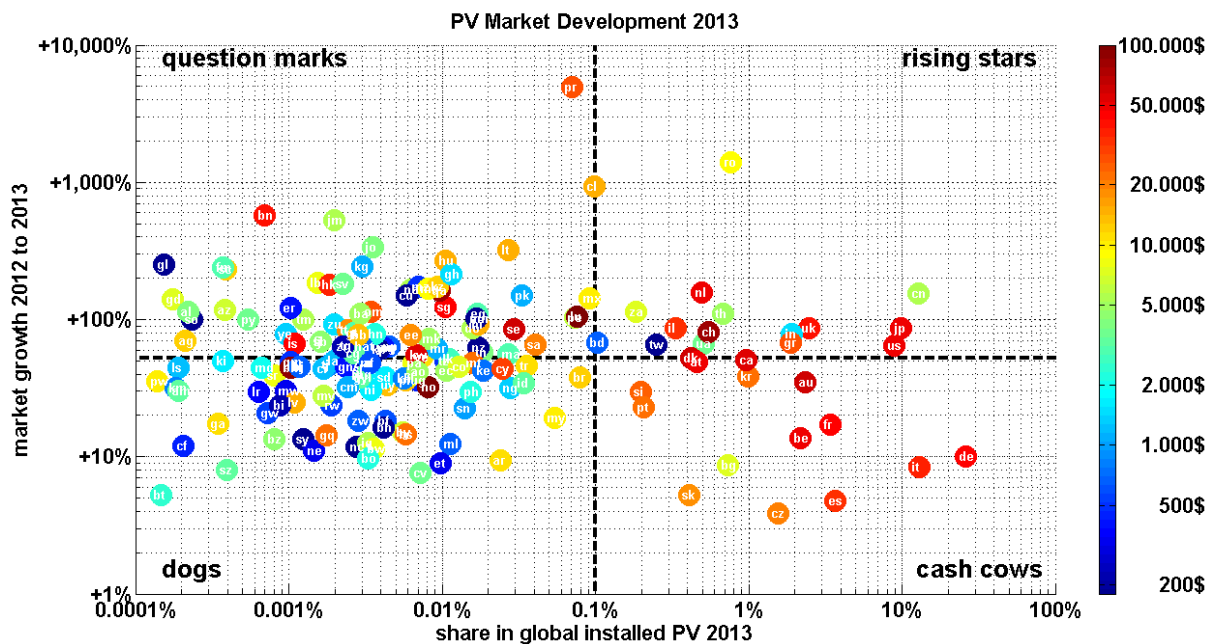
capacity. This might be an indicator that PV is not only used as small off-grid PV solar home systems for sustainable electrification of rural areas, but also as a sustainable alternative for larger solutions as applied in hospitals, schools, supply of commercial appliances and in more and more cases as an upgrade for existing diesel/oil fired power plants. This is especially prevailing in the environment of high diesel prices and remote areas to be supplied with affordable electricity [30, 32].



**Figure 6:** Ratio of added PV capacity in 2013 to cumulative PV installations in 2012, representing growth in PV markets' cumulative capacity.

Figure 6 gives an overview on PV market growth in 2013. A few countries have reached huge growth rates in 2013. In Romania, the cumulative installed PV capacity has grown by more than 1,409% to 1,050 MWp. Further, other emerging countries have shown high growth rates in 2013. Chilean PV capacity at the end of 2013 was more than 913% higher than the end of 2012. Respective growth rates are reached in nearly all regions of the world. A few European PV markets have more than doubled (Romania, Hungary, Lithuania, the Netherlands, Luxembourg). The dominant German market reached a growth rate of only 10%. Other European countries as well show growth rates not higher than 10% (Italy, Bulgaria, Slovakia, Spain and Czech Republic). The highest growth rates in 2013 can be identified in Asian markets, with an average of double the installed capacity per country. Chinese PV installations have grown by about 155%. East Asian PV markets show growth rates of about 150%, whereas South and South East Asian markets grew by about 100% (Thailand, India or Pakistan). The Australian capacity reached a growth rate of only 35% in 2013, after 72% in 2012. MENA region shows a growth of approx. 50%, led by Jordan with a growth in its PV capacity of 336%. Most of the African markets grew by more than two digits. The highest growth rates could be identified in Southern Africa. Especially Sao Tome (300%), the Seychelles (236%), Ghana (214%), Mozambique (174%), Mauritius (168%), Namibia (166%), Eritrea (122%), South Africa (114%) and Egypt (111%) need to be distinguished. Northern Africa remained nearly constant, probably induced by political influences in these regions. Growth rates in the Americas are quite different. While markets such as the Caribbean (120%), Chile (931%), El Salvador (182%), Cuba (150%), Mexico (142%), Grenada (140%) or Peru (103%) have grown on a high scale, the Brazilian market has grown by only 38%, below its huge potential. American and Canadian PV installed capacity grew by about 65% and 51%, respectively. The lowest growth for the Americas in 2013 can be identified for Argentina (9%).





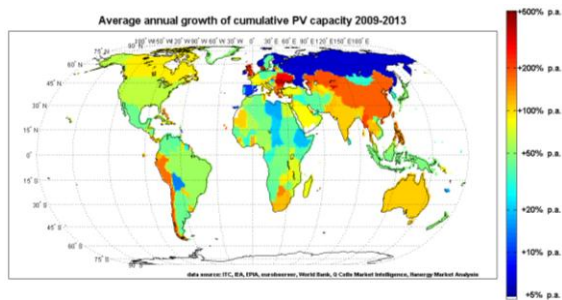
**Figure 7:** Cumulative installed PV by end of 2013 (x-axis) and PV capacities growth rate in 2013 (y-axis). Every bubble represents one country. The color code of the bubbles refers to the GDP/capita (left axis). The code inside of the bubble represents the internet-domain of the relevant country.

Figure 7 tries to give a segmentation of PV markets. Further, an attractiveness of PV markets can be represented. For this, a portfolio analysis chart is applied to PV markets with the use of a logarithmic order. ‘Cash cows’ are mature markets that claim significant installed PV capacities (more than 0.1% of global installed PV at the end of 2013) with relatively low growth rates, but still remaining the most important driver of the global PV market. Germany, Italy, Belgium, France or Australia are typical representatives of this PV market segment. Markets like Portugal, Slovakia or Slovenia are sorted to this segment as well. This segment claims 57% of total installed PV capacity. Even with very low growing markets, such as Spain (5% in 2013) or Czech Republic (4% in 2013), standing for annual installation of a few 100 MWp due to having an installed PV capacity base of few GWp, this is the most important PV market segment. Furthermore, ‘cash cows’ mostly are countries with high incomes. In total 15 countries belong to this group. ‘Rising stars’ are probably the most interesting market segment, as respective installed PV capacities (>0.1% of global PV in 2013) and growth rates are above the world’s long term average (>52%) led to significant installations in the relevant year. South Africa, China, the Netherlands, the United States, Japan and Romania are among those that represent this market segment in 2013. Therefore, this segment stands for 42% of total global PV installations. An interesting question is whether these markets will stay in this segment. In the short- to mid-term, ‘rising stars’ will become ‘cash cows’, as such high growth rates will not be able to be kept with increasing cumulative PV capacities in the years to come. Some countries that in 2012 have been sorted as ‘rising stars’, are now in the ‘cash cow’ group (Denmark or Austria). Markets that show high growth rates, but relatively low installed PV can be named as ‘question marks’. They represent only 0.85% of global PV installations. Markets such as Chile, Mexico, Pakistan, Qatar, Cuba, Hungary

or Egypt show high growth rates, but because of their low installed cumulative PV capacity, they are marginal in global PV. However, if these markets keep their high growth rates for some years, becoming a ‘rising star’ can be a valid opportunity. Most interesting in this segment are markets close to the threshold of becoming a ‘rising star’. Chile, Mexico, Luxembourg, Lithuania or Pakistan are those that are expected to become new ‘rising stars’ in the years to come.

At first view ‘dogs’ seem to be markets of less interest since only 0.7% of total PV is installed in those countries. But especially these are the sustainable, non-feed-in tariff driven markets which often claim a high share of PV off-grid applications, such as Tanzania, Kenya or Ethiopia. The normal way of leaving the ‘dog’-zone is to establish a high growth rate, which goes parallel to becoming a ‘question mark’ and increases the cumulative installed capacity. Few markets are about to manage the hard way of directly becoming a ‘cash cow’, such as Malaysia or Brazil do in a slow but more sustainable way.

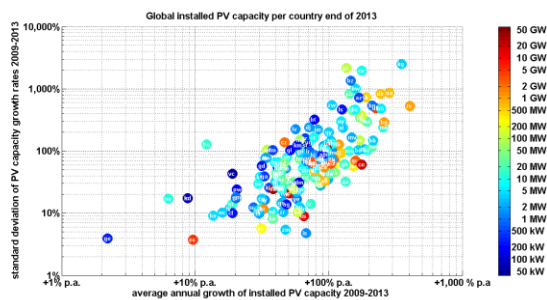
The development of PV in emerging market could be rather different than in the markets where PV developed until now. PV starts to develop in several emerging countries based on call for tenders for large-scale PV systems, rather than rooftop PV. This development will be even stronger in place where neither the population, nor the companies will have the ability to finance PV systems for self-consumption. This trend is already visible in 2013 with the share of large-scale PV increasing in all regions except in Europe. In parallel, small off-grid applications are starting to develop for electrification of households with very low electricity consumption, as it is the case in Bangladesh for instance. This development implies the possible cohabitation in emerging countries between pico PV systems and utility-scale plants, leaving the rooftop market aside.



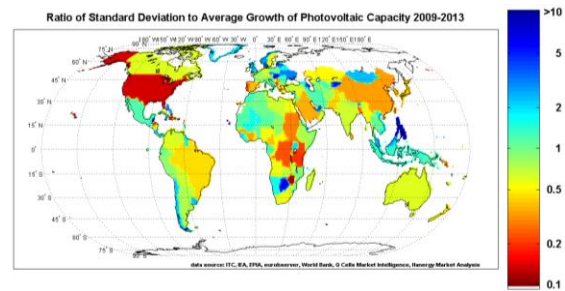
**Figure 8:** Average annual growth rate of cumulative PV capacity between 2009 and 2013 [12, 13, 14].

Figure 8 shows the average annual growth rate in the period from 2009 to 2013. The highest average annual growth rates within this period are able to be identified in Eastern Europe, Central, Southern and Eastern Asia. Romania (406% p.a.), Kyrgyzstan (350% p.a.), Ukraine (283% p.a.), Bulgaria, Macedonia, Bahrain, Denmark, the United Kingdom, Barbados, Burma and Brunei grew annually by more than 200% on average since 2009, mainly caused by the high growth in PV capacities in one particular year. For Europe, Malta (194% p.a.), Slovakia (191% p.a.), Slovenia (187% p.a.), Cyprus (171% p.a.), Greece (158% p.a.) and Italy (97% p.a.) show high average growth rates, as well. In Africa, Cape Verde shows by far the highest average growth rate from 2009 to 2013 with 176% p.a. The Americas claim several high growth regions (especially Peru, Chile and the Caribbean), while others show less growth.

However, high average growth rates are no indicator of a sustainable and constant growth. Deviations in PV markets' annual growth rates are significant, due to markets often being driven by politically driven feed-in tariffs. Thus, average annual growth rates have to be regarded in the context of annual growth rates' standard deviation (Figure 9).



**Figure 9:** Average annual growth rate (x-axis) and growth rates' standard deviation (y-axis) in the period from 2009 to 2013. Every bubble represents one country. The color code of the bubbles refers to the installed PV capacity at the end of 2013 (left axis). The code inside of the bubble gives the internet-domain of the respective country.



**Figure 10:** Ratio of standard deviation to average growth of photovoltaic capacity in the period from 2009 to 2013. The red color refers to very unstable photovoltaic markets, while blue refers to relatively constant growing photovoltaic capacities.

Sustainable growth is a significant but constant growth. Very constant growing PV markets can be identified by the ratio of standard deviation to average growth. As can be seen in Figure 9 and Figure 10, such significant but constant growth in recent years can be identified especially in Iceland, Zambia, the United States, Bangladesh, Portugal, Haiti, Tanzania, Honduras, Kenya, the Democratic Republic of Congo and Qatar. All of them show a ratio of standard deviation to average growth of less than 0.25 (refer to figure 10). Tanzania represents an average annual growth rate of 73% in the period from 2009 to 2013. In 2010 Tanzania's PV capacity grew by 81%, in 2011 by 86%, in 2012 by 78% and in 2013 by 50% to 14.4 MWp at the end of 2013. This is an example of a very constant growth in PV. Moreover, Tanzania's PV market is not driven by any feed-in tariffs, but only the demand for cost effective electricity in rural areas. Thus, Tanzania's PV market can definitely be named as being sustainable. If this constant and high growth continues, Tanzania could reach 24.3 MWp by the end of 2014. The PV capacity of the United States grew by 53% in 2010, 65% in 2011, 78% in 2012 and 65% in 2013, which leads to an average annual growth rate of 65% with a relatively low standard deviation of only 9%. If this constant growth goes on, 20,450 MWp might be cumulatively installed by the end of 2014. Markets such as Ukraine, Denmark, Slovakia or even the United Kingdom show high annual growth rates, but high standard deviations, due to inconstant growth with boom years being followed by such with very little growth [12, 13, 14]. Thus, they show ratios of standard deviation to average growth of more than two. By following this approach, the most inconstant markets are Cape Verde (ratio of 11.2), Hungary (ratio of 10.5), Belize, Kyrgyzstan, Botswana, the Philippines and Zimbabwe showing ratios of more than five.

With the use of this evaluation of average annual growth, the constancy of growth rates, the help of other publications [2,15-23] and the knowledge of four years of analysis of cumulative PV capacities [12, 13, 14], a rough forecast of cumulative PV capacities for the years 2014 and 2015 is possible. In 2014, the global cumulative installed PV capacity might increase by 38% to 182,700 MWp by the end of 2014 (new installations of about 45,200 MWp in 2014) and by the end of 2015, 234,400 MWp (new installations of about 51,700 MWp) of cumulative installed PV capacity might be expected.

#### 4 CONCLUSIONS

In total, 137,50 MWp can be allocated to 191 countries. Analysis of ITC customs data for the years 2001-2012 enables an allocation of 1,793 MWp in 160 countries with no other official data source (EPIA, IEA, etc.) available. The resulting 305 MWp expected to be installed in RoW by EPIA publications cannot be explained. Therefore, the remaining 305 MWp of assumed PV installations of the years 2001-2013 cannot be allocated or might not exist, due to breakage or loss. In addition, 487 MWp are assumed to be installed before 2001, i.e. it is not possible to generate PV market insight by ITC customs data.

One is able to assess that every world region might represent a great PV market potential. Enormous growth rates in specific regions of the world show that PV is on the way to becoming an important part of global electricity supply. Some developing countries are on the road to solar electrification, others use PV as an opportunity to decrease suffering in remote locations. Lower energy costs enabled by reduced dependence on energy imports will contribute to leading these countries to sustainable development and stable growth.

Energy is not a problem one should have due to the simple fact that the best and most powerful energy source is to be found above one's head.

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**Appendix Table 1:**

Alphabetical list of all countries in the world and their cumulative installed PV capacity at the end of 2013. Data is compiled as documented in the paper and based on EPIA, IEA-PVPS and further publications [2,4-23] plus ITC data [3].

	PV capacity at the end of 2013	PV capacity at the end of 2012 [14]	PV capacity at the end of 2011	PV capacity at the end of 2010 [13]	PV capacity at the end of 2009 [12]	Average Growth Rate in 2009-2013	PV/capita at the end of 2013	PV/GDP at the end of 2013	PV share in power plant capacity at the end of 2013
	[MWp]	[MWp]	[MWp]	[MWp]	[MWp]	[-]	[Wp/cap]	[Wp/mUSD]	[-]
Afghanistan	4.60	3.10	1.60	1.30	1.20	40%	0.15	255.1	1.06%
Albania	0.30	0.14	0.10	0.03	0.00	0%	0.09	23.1	0.02%
Algeria	17.60	17.60	15.20	7.10	4.10	44%	0.45	88.6	0.19%
Andorra	0.07	0.05	0.05	0.05	0.05	9%	0.89		0.15%
Angola	9.50	6.70	3.60	2.90	2.20	44%	0.44	91.2	0.85%
Antigua&Barbuda	0.29	0.17	0.12	0.09	0.06	48%	3.22	257.9	0.42%
Argentina	32.70	29.90	14.90	11.70	7.50	45%	0.79	73.3	0.11%
Armenia	0.26	0.20	0.14	0.07	0.02	90%	0.09	25.6	0.01%
Australia	3,200.00	2,380.00	1,380.00	532.00	184.00	104%	137.51	2,319.1	5.54%
Austria	639.00	420.00	184.00	101.00	45.00	93%	73.81	1,501.2	3.26%
Azerbaijan	0.52	0.24	0.19	0.18	0.01	169%	0.06	8.2	0.01%
Bahamas	7.90	6.90	0.56	0.21	0.18	157%	20.95	1,003.5	1.38%
Bahrain	5.70	4.90	0.39	0.05	0.04	246%	4.28		0.11%
Bangladesh	140.00	83.60	58.50	34.70	22.20	58%	0.89	1,251.1	2.20%
Barbados	3.90	2.20	0.38	0.14	0.04	214%	13.68	1,058.3	1.47%
Belarus	7.60	6.60	2.50	2.10	2.00	40%	0.81	118.2	0.09%
Belgium	2,990.00	2,620.00	2,030.00	796.00	318.00	75%	268.37	5,799.2	14.87%
Belize	1.10	0.97	0.03	0.03	0.03	146%	3.31	759.9	0.83%
Benin	1.60	1.10	0.76	0.55	0.16	78%	0.15	219.3	1.41%
Bermuda	1.40	0.97	0.33	0.22	0.15	75%	21.54	251.9	0.65%
Bhutan	0.20	0.19	0.17	0.02	0.02	78%	0.27	109.1	0.01%
Bolivia	4.50	4.10	3.20	3.10	2.70	14%	0.42	187.9	0.35%
Bosnia-Herzegov.	4.00	1.90	0.54	0.13	0.08	166%	1.04	219.3	0.11%
Botswana	4.90	4.40	3.30	2.70	0.11	158%	2.42	305.5	3.05%
Brazil	109.00	78.90	39.90	26.60	19.30	54%	0.54	44.0	0.11%
Brunei	0.95	0.14	0.01	0.01	0.01	212%	2.27	58.1	0.10%
Bulgaria	1,000.00	920.00	149.00	17.40	6.00	259%	138.45	18,676.0	8.50%
Burkina Faso	5.80	4.90	3.50	1.80	2.00	30%	0.34	557.9	2.07%
Burma	23.00	11.40	3.70	0.71	0.24	213%	0.43		1.27%
Burundi	1.20	0.97	0.33	0.19	0.15	68%	0.12	509.4	2.85%
Cambodia	7.70	5.60	3.80	2.10	0.53	95%	0.51	600.2	2.71%
Cameroon	3.30	2.50	1.40	0.98	0.54	57%	0.15	130.3	0.37%
Canada	1,320.00	877.00	628.00	240.00	97.20	92%	37.52	742.5	1.04%
Cape Verde	9.90	9.20	8.50	7.90	0.17	176%	19.84	5,207.4	10.80%
Central Afr. Rep.	0.28	0.25	0.19	0.15	0.14	19%	0.06	129.3	1.06%
Chad	1.00	1.00	0.68	0.54	0.48	20%	0.08	94.5	0.53%
Chile	134.00	13.00	4.60	3.70	2.30	176%	7.60	533.5	1.02%
China	18,310.00	6,890.00	3,250.00	861.00	301.00	177%	12.70	2,403.7	2.44%
Colombia	17.60	12.10	7.20	6.90	4.00	45%	0.36	52.3	0.12%
Comoros	0.25	0.19	0.17	0.16	0.04	58%	0.34	409.6	1.73%
Congo, DR	3.10	1.90	1.40	0.99	0.69	46%	0.05	198.0	0.21%

Congo, Rep.	3.60	2.30	2.00	1.70	1.20	32%	0.81	249.6	1.87%
Costa Rica	8.50	6.10	1.20	1.00	0.86	77%	1.74	207.2	0.37%
Croatia	23.60	12.30	11.90	11.30	6.00	41%	5.50	381.9	0.59%
Cuba	8.00	3.20	2.80	2.10	1.10	64%	0.71		0.19%
Cyprus	34.00	23.70	11.30	6.20	0.63	171%	38.42	1,360.4	2.13%
Czech Republic	2,140.00	2,060.00	1,960.00	1,950.00	463.00	47%	199.96	9,906.9	11.85%
Denmark	573.00	376.00	17.80	6.00	4.10	244%	101.98	1,717.5	5.13%
Djibouti	1.80	1.80	1.60	1.40	0.21	71%	2.06	1,452.6	1.78%
Dominica	0.13	0.08	0.07	0.04	0.02	60%	1.81	272.8	0.54%
Dom. Rep.	21.50	11.50	4.50	1.90	1.30	102%	2.07	386.2	0.55%
Ecuador	14.50	10.20	4.50	1.20	0.98	96%	0.92	186.6	0.35%
Egypt	23.20	11.00	6.00	5.50	3.00	67%	0.28	98.3	0.10%
El Salvador	3.10	1.10	0.41	0.32	0.24	90%	0.49	134.2	0.23%
Equatorial Guinea	2.40	2.10	0.68	0.54	0.29	70%	3.17	142.8	4.35%
Eritrea	1.40	0.63	0.46	0.41	0.34	42%	0.22	536.9	0.96%
Estonia	8.50	4.80	3.40	3.00	3.00	30%	6.60	383.7	0.27%
Ethiopia	13.40	12.30	9.00	6.90	6.70	19%	0.14	422.6	1.59%
F.S. Micronesia	0.51	0.15	0.15	0.15	0.14	38%	4.90	1,643.6	1.58%
Fiji	2.20	1.30	0.65	0.47	0.37	56%	2.50	576.2	0.98%
Finland	12.60	38.20	34.50	26.10	24.30		2.32	47.9	0.08%
France	4,690.00	3,990.00	2,850.00	1,050.00	372.00	88%	72.64	1,680.0	3.88%
Gabon	0.47	0.40	0.35	0.17	0.15	33%	0.28	25.0	0.12%
Gambia	1.40	0.94	0.75	0.69	0.67	20%	0.76	1,558.5	2.20%
Georgia	0.36	0.36	0.36	0.36	0.33	2%	0.08	24.9	0.01%
Germany	35,680.00	32,360.00	24,760.00	17,210.00	9,690.00	38%	430.57	9,892.2	21.22%
Ghana	15.70	5.00	1.80	0.84	0.55	131%	0.61	400.7	0.80%
Greece	2,570.00	1,530.00	624.00	206.00	57.80	158%	230.95	8,873.5	14.74%
Greenland	0.21	0.06	0.06	0.06	0.04	51%	3.68		0.15%
Grenada	0.24	0.10	0.10	0.10	0.08	32%	2.26	307.6	0.47%
Guam	0.13	0.13	0.13	0.13	0.00	0%	0.79		0.02%
Guatemala	3.60	2.00	1.80	1.80	0.53	61%	0.23	76.6	0.17%
Guinea	3.20	2.20	1.80	1.20	0.74	44%	0.27	628.0	0.83%
Guinea - Bissau	0.99	0.82	0.62	0.47	0.25	41%	0.58	1,023.0	6.07%
Guyana	4.00	2.90	2.70	1.50	0.25	100%	5.00	1,552.4	2.28%
Haiti	4.10	2.50	1.40	0.86	0.59	62%	0.40	558.1	1.65%
Honduras	5.00	2.80	1.70	1.10	0.76	60%	0.62	287.0	0.31%
Hong Kong	2.50	0.90	0.33	0.14	0.14	106%	0.35	10.1	0.00%
Hungary	14.40	3.90	3.40	1.80	9.10	12%	1.45	103.8	0.16%
Iceland	1.50	0.90	0.53	0.33	0.19	68%	4.55	106.6	0.06%
India	2,610.00	1,460.00	470.00	177.00	136.00	109%	2.08	1,393.6	1.63%
Indonesia	46.70	34.70	13.30	9.20	10.20	46%	0.19	55.2	0.12%
Iran	9.10	9.10	9.10	4.30	2.20	43%	0.12	17.7	0.02%
Iraq	4.50	4.00	3.10	2.20	1.60	30%	0.13	24.9	0.04%
Ireland	2.00	10.90	7.00	5.00	13.00		0.43	9.1	0.03%
Israel	455.00	243.00	158.00	40.20	18.20	123%	58.71	1,868.9	3.48%
Italy	17,780.00	16,300.00	12,810.00	3,490.00	1,180.00	97%	289.72	8,059.8	14.42%
Ivory Coast	2.30	1.60	1.20	0.93	0.80	30%	0.11	95.5	0.18%
Jamaica	2.70	0.43	0.43	0.43	0.24	83%	0.97	187.2	0.24%
Japan	13,500.00	7,230.00	4,910.00	3,610.00	2,630.00	51%	106.34	2,292.8	4.78%

Jordan	4.80	1.10	0.79	0.79	0.31	98%	0.66	166.4	0.21%
Kazakhstan	12.80	4.70	1.30	0.29	0.17	195%	0.78	68.1	0.07%
Kenya	25.40	17.80	12.30	8.70	7.00	38%	0.57	755.5	1.70%
Kiribati	0.51	0.34	0.20	0.15	0.15	36%	5.00	3,059.7	5.13%
Korea, DPR	5.30	3.30	2.40	2.20	0.00	0%	0.21		0.06%
Korea, Rep.	1,350.00	974.00	786.00	655.00	439.00	32%	27.40	1,211.3	1.72%
Kuwait	9.30	6.00	3.50	1.80	1.40	61%	2.76	52.7	0.08%
Kyrgyzstan	4.10	1.20	0.02	0.02	0.01	350%	0.74	661.5	0.11%
Laos	2.70	1.80	0.68	0.68	0.31	72%	0.40	328.2	0.39%
Latvia	1.50	1.20	0.68	0.11	0.25	57%	0.73	52.7	0.06%
Lebanon	2.10	0.74	0.74	0.71	0.65	34%	0.44	52.4	0.09%
Lesotho	0.26	0.18	0.12	0.01	0.01	126%	0.13	103.0	0.33%
Liberia	0.87	0.67	0.49	0.36	0.10	72%	0.20	563.0	5.19%
Libya	3.90	2.80	2.50	2.20	2.00	18%	0.63		0.05%
Lithuania	37.00	8.80	0.74	0.62	0.93	151%	12.26	863.0	0.77%
Luxembourg	104.00	50.90	33.30	30.10	26.40	41%	196.23	1,756.7	5.75%
Macedonia	11.20	6.50	2.90	0.38	0.07	256%	5.32	1,072.9	0.66%
Madagascar	5.70	3.50	2.30	1.50	0.54	80%	0.25	575.1	1.42%
Malawi	1.30	1.00	0.55	0.37	0.13	78%	0.08	231.3	0.42%
Malaysia	73.70	61.90	13.50	11.30	11.00	61%	2.48	256.0	0.29%
Maldives	2.30	1.80	1.20	0.23	0.06	149%	6.67	1,068.0	2.22%
Mali	15.50	13.80	10.60	3.00	2.30	61%	1.01	1,454.5	2.57%
Malta	21.60	14.60	9.60	1.10	0.29	194%	50.35	2,360.2	3.54%
Mauritania	12.60	7.80	1.70	0.91	0.69	107%	3.24	2,948.6	5.59%
Mauritius	11.00	4.10	1.60	1.30	0.32	142%	8.84	978.5	1.34%
Mexico	125.00	51.70	35.30	30.30	28.20	45%	1.02	107.9	0.21%
Moldova	0.91	0.63	0.20	0.16	0.08	84%	0.26	129.7	0.03%
Mongolia	3.50	3.50	3.30	3.10	1.10	34%	1.23	399.5	0.34%
Morocco	36.90	23.70	18.00	16.80	5.60	60%	1.12	371.9	0.65%
Mozambique	9.60	3.50	2.50	1.20	1.20	68%	0.37	763.8	0.41%
Namibia	8.50	3.20	2.80	2.30	2.10	42%	3.69	681.2	2.16%
Nepal	6.20	3.80	3.70	3.20	1.50	43%	0.22	326.7	0.85%
Netherlands	695.00	262.00	139.00	86.10	66.10	79%	40.40	809.7	3.05%
New Caledonia	3.80	3.40	3.20	2.80	2.10	16%	14.84		0.86%
New Zealand	23.50	14.50	7.50	5.50	4.40	52%	5.22		0.24%
Nicaragua	4.70	3.60	2.30	2.20	1.20	41%	0.77	487.8	0.64%
Niger	2.00	1.80	1.80	0.80	0.42	48%	0.11	332.4	1.45%
Nigeria	37.80	28.70	23.30	11.60	6.70	54%	0.22	154.9	0.34%
Norfolk Island	0.24	0.24	0.17	0.07	0.06	41%			0.00%
Norway	11.10	8.40	7.80	7.30	8.70	6%	2.20	22.6	0.04%
Oman	4.70	2.20	1.60	0.70	0.61	67%	1.79	65.5	0.08%
Pakistan	45.50	18.20	10.80	4.00	2.30	111%	0.25	215.9	0.22%
Panama	8.90	6.00	1.50	0.78	0.66	92%	2.30	284.2	0.64%
Papua New Guinea	4.20	3.00	1.20	1.00	0.93	46%	0.57	338.9	0.66%
Paraguay	0.74	0.37	0.18	0.06	0.05	96%	0.11	28.5	0.29%
Peru	100.00	49.20	14.80	10.20	1.90	169%	3.29	565.2	1.60%
Philippines	21.00	16.20	14.30	12.30	0.60	143%	0.21	93.4	0.12%
Poland	7.90	5.80	2.90	1.80	2.00	41%	0.21	15.3	0.02%
Portugal	283.00	231.00	166.00	126.00	95.90	31%	26.77	1,195.4	1.81%

Puerto Rico	96.00	1.90	1.90	1.90	3.10	136%	26.03	972.1	0.00%
Qatar	13.10	5.00	2.40	1.20	0.44	134%	6.04	75.7	0.24%
Rep. of Palau	0.19	0.14	0.14	0.14	0.09	21%	9.05	892.4	0.70%
Romania	1,050.00	69.60	7.70	5.50	1.60	406%	48.39	5,532.8	4.71%
Russia	13.00	114.00	58.20	35.70	28.90		0.09	6.8	0.01%
Rwanda	2.60	2.10	1.20	0.75	0.56	47%	0.22	409.2	4.67%
Sao Tome&Principe	0.08	0.02	0.01	0.01	0.01	68%	0.41	322.2	0.72%
Saudi Arabia	55.20	33.40	21.30	9.10	4.70	85%	1.91	95.7	0.11%
Senegal	19.10	15.60	10.10	4.70	4.90	41%	1.35	1,321.9	2.59%
Seychelles	0.53	0.16	0.10	0.05	0.04	91%	5.70	500.2	0.38%
Serbia	5.70	3.50	1.30	0.48	0.41	93%	0.60	131.7	0.06%
Sierra Leone	4.00	2.80	0.40	0.30	0.15	127%	0.66	1,361.1	4.95%
Singapore	14.30	6.40	4.70	3.00	1.40	79%	2.64	58.4	0.13%
Slovakia	559.00	531.00	470.00	145.00	7.80	191%	102.57	5,819.0	6.97%
Slovenia	270.00	208.00	87.20	36.30	4.00	187%	130.31	5,370.0	7.68%
Solomon Island	2.20	1.30	0.55	0.32	0.18	87%	3.92	2,538.4	5.45%
Somalia	0.32	0.16	0.11	0.08	0.08	41%	0.03		2.01%
South Africa	252.00	118.00	68.00	39.50	12.00	114%	4.77	627.2	0.57%
Spain	5,020.00	4,790.00	4,420.00	3,840.00	3,480.00	10%	106.97	3,399.1	5.52%
Sri Lanka	15.30	10.10	8.30	6.70	5.20	31%	0.72	258.5	0.53%
St. Helena	0.01	0.01	0.01	0.01	0.01	0%	2.50		0.34%
St. Lucia	0.07	0.07	0.07	0.07	0.05	9%	0.38	57.8	0.09%
St. Vincent&Gre.	0.06	0.06	0.06	0.06	0.03	19%	0.55	86.8	0.13%
Sudan	5.80	4.20	2.70	2.10	1.60	38%	0.15	90.5	0.36%
Suriname	1.10	0.79	0.56	0.48	0.42	27%	2.04	255.5	0.21%
Swaziland	0.54	0.50	0.46	0.34	0.07	67%	0.43	136.1	0.43%
Sweden	40.40	21.90	14.60	11.20	9.40	44%	4.22	74.9	0.12%
Switzerland	748.00	414.00	214.00	90.70	66.90	83%	92.60	1,134.5	4.32%
Syria	1.70	1.50	1.20	0.84	0.54	33%	0.08		0.02%
Taiwan	342.00	207.00	66.00	23.00	8.40	153%	14.66		0.69%
Tajikistan	2.50	1.70	0.70	0.33	0.16	99%	0.30	383.3	0.05%
Tanzania	14.40	9.60	5.40	2.90	1.60	73%	0.29	603.2	1.20%
Thailand	926.00	439.00	213.00	46.50	40.00	119%	13.82	2,678.8	2.60%
Togo	3.30	2.00	1.40	0.93	0.19	104%	0.48	895.3	1.56%
Trinidad&Tobago	3.30	1.80	0.38	0.14	0.05	185%	2.46	140.4	0.20%
Tunisia	25.00	15.90	9.80	3.20	1.80	93%	2.27	538.4	0.69%
Turkey	48.70	33.40	13.90	6.20	4.90	78%	0.65	62.9	0.12%
Turkmenistan	1.70	0.85	0.50	0.13	0.09	108%	0.32	60.6	0.05%
Uganda	9.40	6.90	5.00	4.90	1.10	71%	0.25	558.8	1.45%
Ukraine	692.00	416.00	193.00	8.70	3.20	283%	15.30	4,234.4	1.26%
UAE	118.00	118.00	44.00	15.50	36.10	34%	12.63	327.6	0.47%
United Kingdom	3,370.00	1,810.00	955.00	72.00	30.40	224%	53.38	1,378.4	3.67%
United States	12,200.00	7,400.00	4,160.00	2,520.00	1,650.00	65%	38.12	813.8	1.14%
Uruguay	6.00	4.50	2.40	2.00	0.24	124%	1.76	129.2	0.52%
Uzbekistan	2.70	1.40	0.33	0.23	0.20	92%	0.09	59.6	0.02%
Venezuela	10.10	6.60	4.40	2.60	2.60	40%	0.33	31.9	0.04%
Vietnam	11.80	11.80	9.70	7.20	2.40	49%	0.13	95.4	0.07%
Western Sahara	0.25	0.25	0.25	0.25	0.00	0%	0.44		0.11%
Yemen	1.30	0.73	0.50	0.29	0.21	58%	0.05	41.0	0.11%

Zambia	4.00	2.70	1.80	1.30	0.85	47%	0.28	208.3	0.21%
Zimbabwe	3.90	3.30	3.00	3.00	0.22	105%	0.28	403.9	0.19%



**Appendix Table 2:**

Alphabetical list of all countries in the world with data for reasons of further analyses and comparing.

	Population [26]	GDP [29]	GDP/capita	Total power plant capacity in operation [31]	Population weighted irradiation [25]
	[1000pop]	[bnUSD]	[USD]	[MW]	[kWh/m <sup>2</sup> /y]
Afghanistan	30,552	18.03	590	431.3	2,164
Albania	3,173	12.96	4,084	1,693.0	1,923
Algeria	39,208	198.54	5,064	9,271.1	1,993
Andorra	79			46.6	
Angola	21,472	104.12	4,849	1,112.0	2,084
Antigua&Barbuda	90	1.12	12,495	68.9	
Argentina	41,446	446.04	10,762	29,935.9	1,962
Armenia	2,977	10.14	3,405	3,216.9	1,830
Australia	23,343	1,384.15	59,296	54,765.6	1,914
Austria	8,495	417.66	49,165	18,632.7	1,389
Azerbaijan	9,413	63.40	6,736	7,053.8	1,685
Bahamas	377	7.87	20,882	562.7	2,198
Bahrain	1,332			5,113.1	
Bangladesh	156,595	111.91	715	6,216.3	1,908
Barbados	285	3.69	12,930	262.1	
Belarus	9,357	64.27	6,869	7,998.1	1,264
Belgium	11,104	513.86	46,277	17,065.8	1,203
Belize	332	1.45	4,360	130.9	1,807
Benin	10,323	7.29	707	112.0	
Bermuda	65	5.56	85,494	213.9	
Bhutan	754	1.83	2,432	1,501.5	1,943
Bolivia	10,671	23.95	2,244	1,268.7	2,037
Bosnia-Herzegovina	3,829	18.24	4,764	3,598.4	1,548
Botswana	2,021	16.04	7,936	155.6	2,302
Brazil	200,362	2,476.65	12,361	103,198.2	1,883
Brunei	418	16.36	39,138	959.3	1,915
Bulgaria	7,223	53.54	7,413	10,764.6	1,606
Burkina Faso	16,935	10.40	614	275.1	2,164
Burma	53,259			1,788.2	1,939
Burundi	10,163	2.36	232	40.9	1,803
Cambodia	15,135	12.83	848	276.0	1,937
Cameroon	22,254	25.32	1,138	898.9	1,875
Canada	35,182	1,777.79	50,531	126,081.0	1,554
Cape Verde	499	1.90	3,810	81.8	2,283
Central Afr. Rep.	4,616	2.17	469	26.2	2,031
Chad	12,825	10.58	825	187.0	2,222
Chile	17,620	251.19	14,256	12,946.5	2,124
China	1,385,567	7,321.94	5,284	704,649.7	1,631
Colombia	48,321	336.35	6,961	14,287.8	1,732
Comoros	735	0.61	830	14.2	2,287
Congo, DR	67,514	15.65	232	1,469.8	1,848
Congo, Rep.	4,448	14.43	3,243	189.0	1,638

Costa Rica	4,872	41.03	8,422	2,290.7	1,735
Croatia	4,290	61.79	14,403	3,976.9	1,586
Cuba	11,266			4,221.9	1,987
Cyprus	885	24.99	28,240	1,560.2	2,244
Czech Republic	10,702	216.01	20,184	15,921.1	1,251
Denmark	5,619	333.62	59,373	10,596.3	1,287
Djibouti	873	1.24	1,419	99.5	2,318
Dominica	72	0.48	6,618	23.9	2,386
Dom. Rep.	10,404	55.67	5,351	3,910.1	1,995
Ecuador	15,738	77.70	4,937	4,086.8	1,660
Egypt	82,056	236.00	2,876	22,719.0	2,242
El Salvador	6,340	23.10	3,643	1,341.0	2,206
Equatorial Guinea	757	16.81	22,202	52.8	1,632
Eritrea	6,333	2.61	412	144.0	2,215
Estonia	1,287	22.15	17,214	3,150.5	1,298
Ethiopia	94,191	31.71	337	832.0	2,205
F.S. Micronesia	3			16.5	1,458
Fiji	104	0.31	2,984	31.8	2,016
Finland	881	3.82	4,334	221.2	1,976
France	5,426	263.18	48,503	16,538.8	1,181
Gabon	64,291	2,779.72	43,237	115,630.7	1,441
Gambia	249			227.3	1,785
Georgia	1,672	18.79	11,239	378.9	1,667
Germany	1,849	0.90	486	62.3	2,129
Ghana	4,341	14.43	3,325	3,454.2	1,678
Greece	82,727	3,600.83	43,527	132,257.1	1,222
Greenland	25,905	39.18	1,512	1,951.7	1,852
Grenada	11,128	289.63	26,027	14,866.3	1,753
Guam	57			141.5	
Guatemala	106	0.78	7,362	51.2	2,317
Guinea	466			650.0	2,344
Guinea - Bissau	165			563.1	2,212
Guyana	15,468	46.98	3,037	2,098.4	1,997
Haiti	11,745	5.10	434	381.1	2,046
Honduras	1,704	0.97	568	15.3	2,089
Hong Kong	800	2.58	3,221	171.3	1,784
Hungary	10,317	7.35	712	244.8	2,146
Iceland	8,098	17.42	2,152	1,595.4	1,932
India	7,204	248.73	34,526	0.0	1,506
Indonesia	9,955	138.70	13,932	9,108.2	1,445
Iran	330	14.07	42,651	2,388.7	
Iraq	1,252,140	1,872.85	1,496	157,537.3	2,032
Ireland	249,866	846.34	3,387	37,324.1	1,809
Israel	77,447	514.06	6,638	55,211.9	2,041
Italy	33,765	180.61	5,349	11,956.8	2,073
Ivory Coast	4,627	220.82	47,725	7,263.6	1,055
Jamaica	7,733	242.93	31,415	12,590.8	2,247
Japan	60,990	2,192.36	35,946	104,897.3	1,720
Jordan	20,316	24.07	1,185	1,293.1	1,818

Kazakhstan	2,784	14.43	5,182	1,116.4	2,132
Kenya	127,144	5,896.79	46,379	269,284.0	1,578
Kiribati	7,274	28.84	3,965	2,294.2	2,103
Korea, DPR	16,441	188.05	11,438	19,077.0	1,709
Korea, Rep.	44,354	33.62	758	1,467.4	2,124
Kuwait	102	0.17	1,634	9.4	2,178
Kyrgyzstan	24,895			9,285.0	1,874
Laos	49,263	1,114.47	22,623	77,082.3	1,770
Latvia	3,369	176.59	52,416	10,967.0	2,134
Lebanon	5,548	6.20	1,117	3,762.7	1,840
Lesotho	6,770	8.23	1,215	681.3	1,829
Liberia	2,050	28.48	13,893	2,479.6	1,307
Libya	4,820	40.09	8,318	2,377.6	2,159
Lithuania	2,074	2.52	1,217	78.5	
Luxembourg	4,294	1.55	360	15.9	1,781
Macedonia	6,202			7,956.5	2,110
Madagascar	3,017	42.87	14,210	4,755.1	1,277
Malawi	530	59.20	111,700	1,706.0	
Malaysia	2,107	10.44	4,954	1,673.8	1,718
Maldives	22,925	9.91	432	396.4	2,091
Mali	16,363	5.62	344	310.9	2,088
Malta	29,717	287.93	9,689	25,591.4	1,766
Mauritania	345	2.15	6,242	101.4	
Mauritius	15,302	10.66	696	588.6	2,185
Mexico	429	9.15	21,333	588.8	2,188
Moldova	404			416.9	2,323
Mongolia	3,890	4.27	1,099	212.9	2,202
Morocco	1,244	11.24	9,037	810.2	2,244
Mozambique	122,332	1,158.15	9,467	59,542.8	2,136
Namibia	3,487	7.02	2,012	2,999.6	1,492
Nepal	2,839	8.76	3,086	1,028.7	1,910
Netherlands	33,008	99.21	3,006	5,658.6	2,153
New Caledonia	25,834	12.57	487	2,321.2	2,026
New Zealand	2,303	12.48	5,418	385.6	2,352
Nicaragua	27,759	18.98	684	722.3	2,176
Niger	16,759	836.07	49,888	21,529.8	1,242
Nigeria	256			437.0	2,129
Norfolk Island	4,506			9,681.4	1,644
Norway	6,080	9.64	1,585	728.5	2,016
Oman	17,831	6.02	337	135.9	2,382
Pakistan	173,615	243.99	1,405	11,101.1	1,978
Panama	54			106.1	2,272
Papua New Guinea	5,043	491.06	97,376	30,092.5	1,103
Paraguay	2,632	71.78	27,273	5,750.5	2,239
Peru	182,143	210.74	1,157	21,071.4	2,135
Philippines				0.000	2,056
Poland	3,864	31.32	8,105	1,378.2	1,728
Portugal	7,321	12.39	1,693	630.6	1,825
Puerto Rico	6,802	26.01	3,824	257.6	1,898

Qatar	30,376	176.93	5,825	6,141.1	2,006
Rep. of Palau	98,394	224.77	2,284	17,393.9	1,842
Romania	38,217	515.67	13,493	36,481.1	1,235
Russia	10,608	237.57	22,396	15,437.4	1,891
Rwanda	3,688	98.76	26,778	0.000	2,142
Sao Tome&Principe	2,169	172.98	79,752	5,440.2	2,065
Saudi Arabia	21	0.21	10,138	26.8	2,020
Senegal	875			548.7	2,292
Seychelles	21,699	189.78	8,746	21,228.9	1,500
Serbia	142,834	1,899.09	13,296	228,525.8	1,403
Sierra Leone	11,777	6.35	540	53.0	1,831
Singapore	193	0.25	1,286	11.0	
Slovakia	28,829	576.82	20,008	48,349.1	2,296
Slovenia	14,133	14.45	1,022	719.4	2,126
Solomon Island	93	1.06	11,394	140.7	2,168
Somalia	9,511	43.29	4,552	10,108.5	1,573
South Africa	6,092	2.94	482	76.8	1,861
Spain	5,412	245.02	45,274	11,053.6	
Sri Lanka	5,450	96.06	17,626	7,461.8	1,286
St. Helena	2,072	50.28	24,266	3,244.3	1,483
St. Lucia	561	0.87	1,545	38.1	1,953
St. Vincent&Gre.	10,496			15.6	2,100
Sudan	52,776	401.80	7,613	44,063.8	2,166
Suriname	46,927	1,476.88	31,472	85,938.6	1,886
Swaziland	21,273	59.19	2,782	2,850.0	1,813
Sweden	4			3.0	2,149
Switzerland	182	1.21	6,654	74.4	
Syria	109	0.69	6,341	45.9	2,277
Taiwan	37,964	64.05	1,687	1,586.3	2,271
Tajikistan	539	4.30	7,986	516.5	1,872
Tanzania	1,250	3.97	3,175	124.4	1,982
Thailand	9,571	539.28	56,345	33,635.8	1,218
Togo	8,078	659.31	81,618	16,572.6	1,467
Trinidad&Tobago	21,898			7,705.3	2,026
Tunisia	23,330			49,160.3	1,632
Turkey	8,208	6.52	795	4,909.0	1,996
Turkmenistan	49,253	23.87	485	1,186.6	2,043
Uganda	67,011	345.67	5,158	34,706.4	1,903
Ukraine	6,817	3.69	541	208.7	1,931
UAE	1,341	23.50	17,522	1,672.4	2,136
United Kingdom	10,997	46.43	4,222	3,589.8	1,916
United States	74,933	774.78	10,340	40,541.9	1,839
Uruguay	5,240	28.06	5,355	3,661.3	1,894
Uzbekistan	37,579	16.82	448	640.5	1,980
Venezuela	45,239	163.42	3,612	54,084.4	1,398
Vietnam	9,346	360.25	38,545	25,191.4	2,261
Western Sahara	63,136	2,444.88	38,724	88,434.3	1,128
Yemen	320,051	14,991.30	46,840	1,058,995.2	1,796
Zambia	3,407	46.43	13,629	1,139.9	1,853

Zimbabwe	28,934	45.32	1,566	13,121.2	1,976
Venezuela	30,405	316.48	10,409	26,904.1	1,934
Vietnam	91,680	123.68	1,349	15,984.4	1,665
Virgin Islands	28			0.0	
Western Sahara	567			235.7	2,209
Yemen	24,407	31.72	1,300	1,203.1	2,295
Zambia	14,539	19.20	1,321	1,881.4	2,201
Zimbabwe	14,150	9.66	682	2,005.8	2,221