Installation of Photovoltaic Panels on French Warehouse Rooftops

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Abstract

The intermittent nature of solar energy makes its use problematic without storage or a backup source of energy. Southern France is blessed with solar radiation, and solar energy can offer a partial solution to the problem of energy supply. The question we asked: can photovoltaics contribute in a significant way to power production?

The amount of solar energy reaching the earth is on average 100 watts per square meter; that is 100 kWh a year, if we consider that the annual period of sunshine is of 1,000 hours (this value can reach 2500 hours in desert regions). Current photovoltaic systems operate at a little more than 10% efficiency. By multiplying the power installed by the number of sunshine hours, we can estimate the annual quantity of energy produced.

A criticism often made of photovoltaics is the total space required for this form of energy if we want to use it widely. A simple calculation shows that one would need a surface area of 10 square kilometers to produce 1 TWh. Based on this, it would take approximately 5,000 km2 to produce the electricity France needs based on photovoltaics.

Instead of installing fields of solar panels on the ground, why not install solar photovoltaic panels on our buildings? This study explores this concept, including the available surfaces on the warehouse roofs in France, the amount of available annual sunshine, and the electricity production from the potential installed power.

The total built surface area in France is 10,000 km2. If half of that built area were covered with solar panels, it would produce on-site a quantity of energy corresponding to the electricity consumed if France. While we could not assure the consistency of production because of the variable nature of the solar energy, we could imagine a massive production of electricity in this way with all the advantages of such installations in terms of benefits for the environment and energy independence.

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Introduction

Energy is at the heart of our everyday lives. The increasing costs of fossil fuel and its derived energies and the promulgation of future law's on energy are going to have an important impact on the way we produce and consume energy.

All the analysts state categorically that, in spite of the important potential of its sunny zones and its industrial capacities, France is late in the development of thermal solar energy as well as in the efficiency of its policies of controlling energy. The debate is no longer to pit renewable energies against energy supplied by nuclear power or fossil fuels. Analysts believe that for some decades, we will still need the latter for energy production. It would be impossible to maintain the stability in the electricity networks on those days or at night without wind or sun without significant storage capability or backup of existing nuclear or fossil energy.

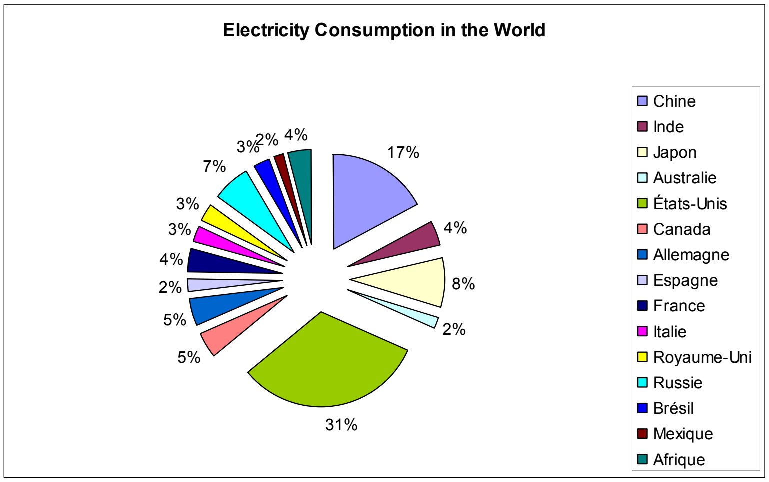
Indeed, our civilization has several credible alternatives on the horizon to develop cleaner, renewable energies. This time frame represents three to four generations of researchers who may discover new sources of energy and reduce their costs. Meanwhile, we have to act. Let us build some insurance.

I. Sustainable Energy

a. Electricity consumption in the World

On both graphs below, you can see electricity consumption in the world. We can see that the USA and China are the largest consumers of electricity globally. In addition, both countries have the largest population. France, on the other hand, consumes only 4% of the global consumption, produced essentially from nuclear power.

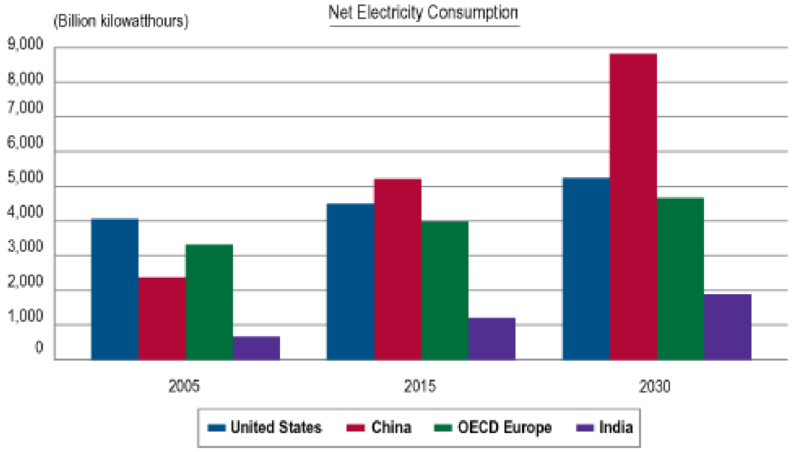
Graph 1



On this second graph, we can see that compared to 2005, electricity demand is projected to grow throughout the world, especially in China.

Graph 2

Worldwide Electricity Demand Growth

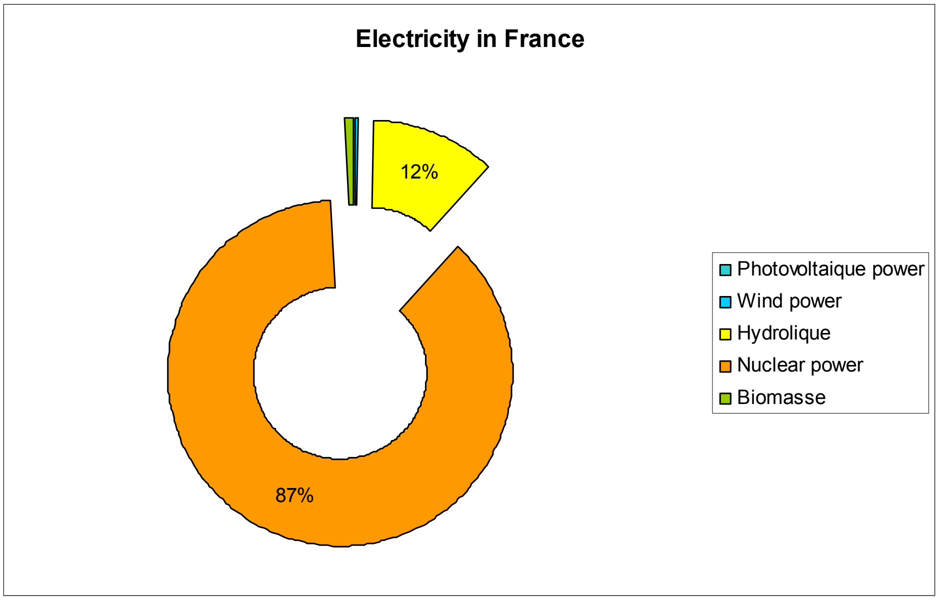


Source: U.S. Department of Energy, Energy Information Administration, *International Energy Outlook 2008.*

b. Electricity in France

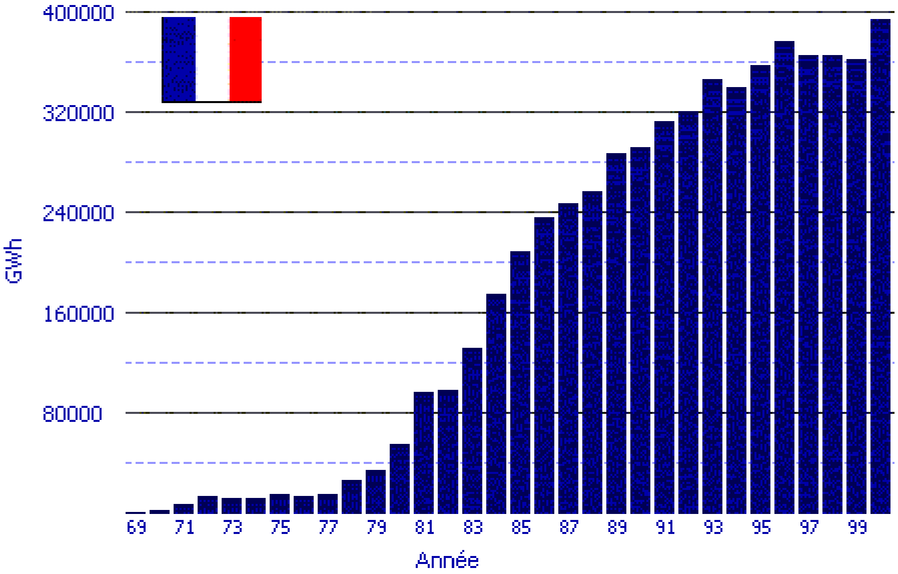
In France, 87% of electricity consumption is produced by nuclear power. Just less than 15% of electricity consumption is produced by renewable energy. This graph below clearly shows this key role played by nuclear energy.

Graph 3



Since 70's, France has invested enormously in the nuclear power. Today, 400,000 GWh has been produced from nuclear power. The rapid growth over more than two decades is shown in the graph below. It is the primary source of electricity in France.

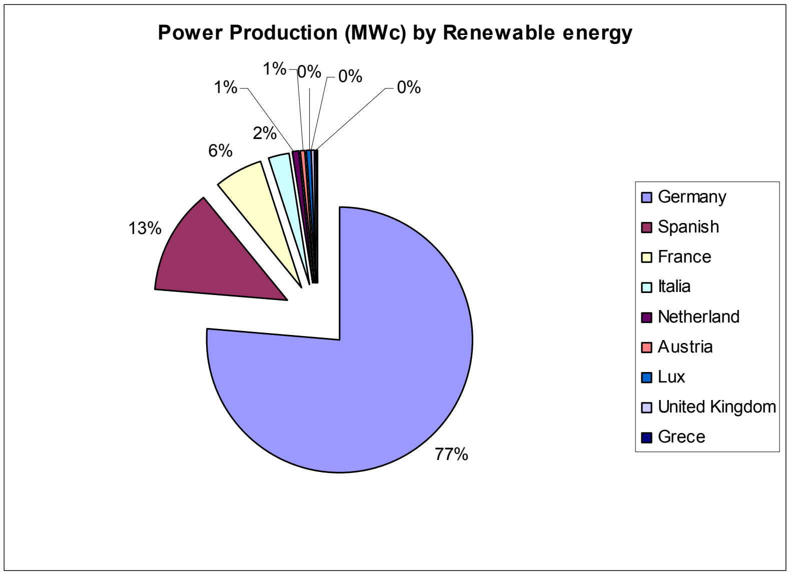
Graph 4



c. Sustainable Energy in France

In Europe, sustainable energy is important, especially for Germany and Spain who combined have more than 80% of electricity power production from renewable energy. France also has an important campaign in renewable energy. Those percentages are shown below.

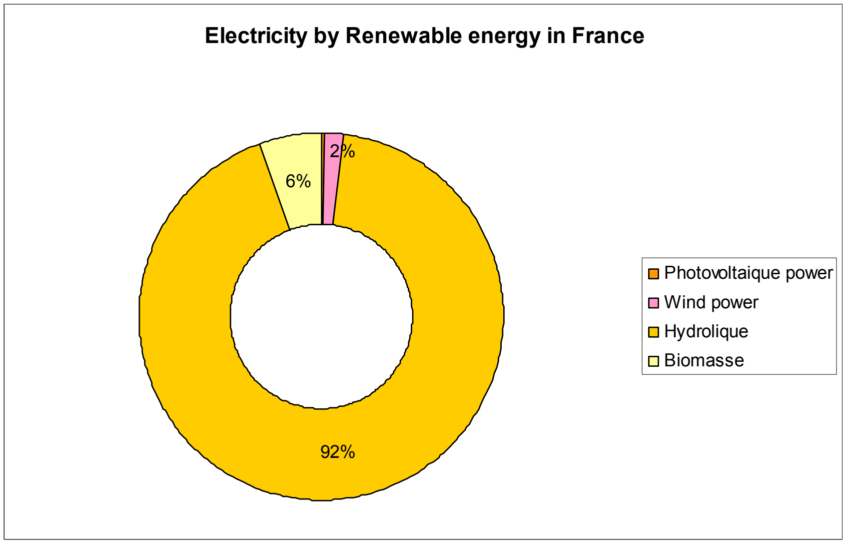
Graph 5



In Europe, an important campaign in sustainable energy has been created called "Sustainable Energy Europe Campaign." Sustainable Energy Europe is a European Commission initiative within the framework of the Intelligent Energy – Europe Programme, which will contribute to achieving the European Union's energy policy targets within the fields of renewable energy sources, energy efficiency, clean transport and alternative fuels.

On the graph below, the importance of electricity produced from hydro power is shown, with 92% of electricity being produced from this renewable energy. Photovoltaics play only a small part in France, less than 1%, whereas wind power and biomass have a rapidly expanding market.

Graph 6



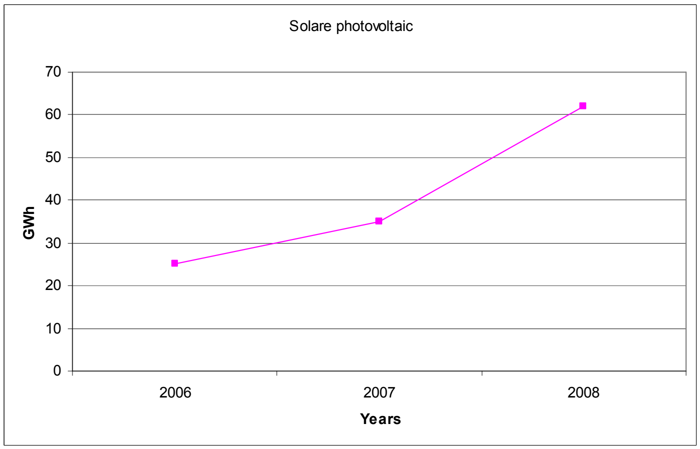
II. Photovoltaics in France

a. Growth since 2007

Since 2004 with the institution of the tax credit, the photovoltaic installation market has seen important growth. The increase of the tax credit from 40% to 50% in 2005 and, especially, the repurchase implemented in July 2006, prompted an important increase in the number of installations. Likewise, the growth of the French industrial or business park linked to the network between 2003 and 2007 was, on average, greater than 100%. 2007 was really the year this took off: 35 MW more photovoltaics, or more than all the systems installed before 2000, were built.

Graph 7 below clearly shows this growth, this takeoff, in 2007.

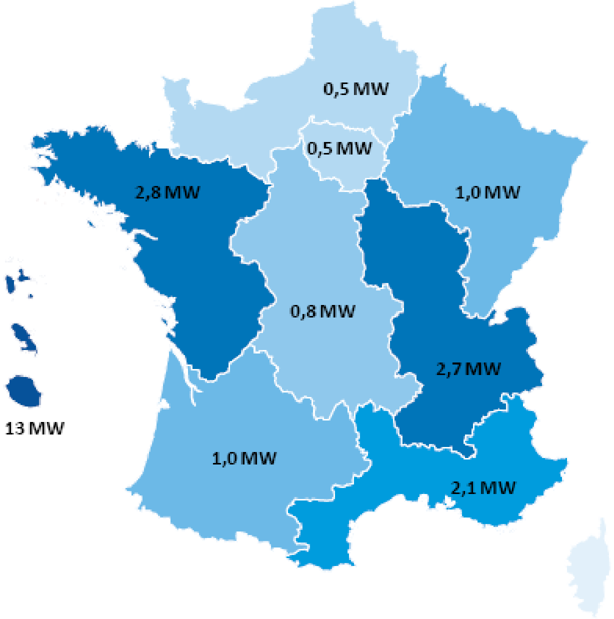
Graph 7



b. The geographical distribution of Photovoltaic's

The Rhône-Alpes, the region near the Mediterranean coast, and the West of France are the leaders in the number of installed photovoltaic plants; these three zones combined represented 65% of the metropolitan parks at the end of 2007.

Map 1: Electricity consumption in France



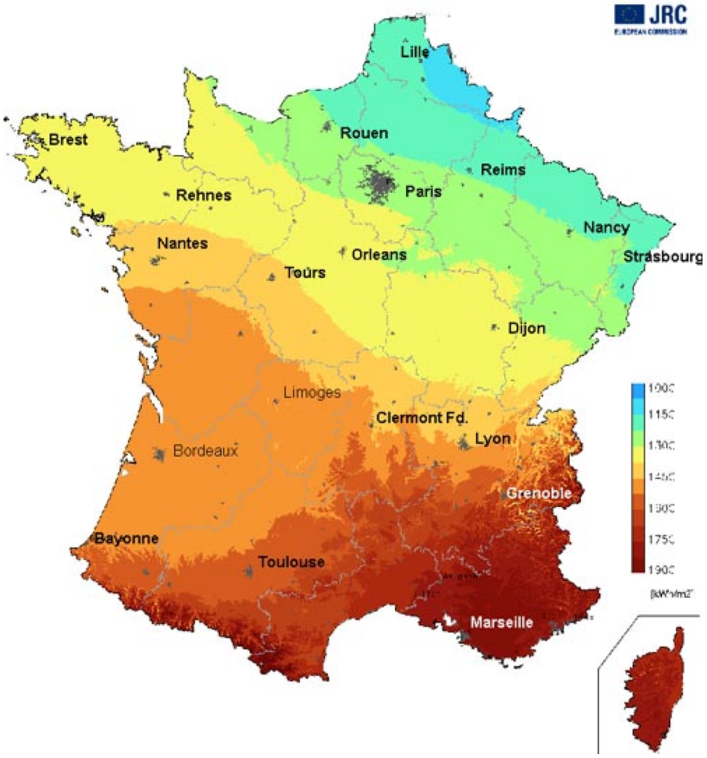
c. French solar map

The differences in solar radiation in France are essentially due to the climatic conditions influencing the number of sunshine hours. While the southern area is most favorable, especially the Cote d'Azure, an installation of photovoltaic solar panels is not only profitable in the South. The North of France can also be very productive. The variation in the periods of sunshine between the South and the North of France will only determine what kind of sensor surfaces will be set up. As proof, Germany, where the climatic conditions are even less favorable than those in the North of France, is the European leader in the solar energy.

From the two French Solar maps below, we can see that the period of sunshine is more favorable in the bottom half of France than in the north of France.

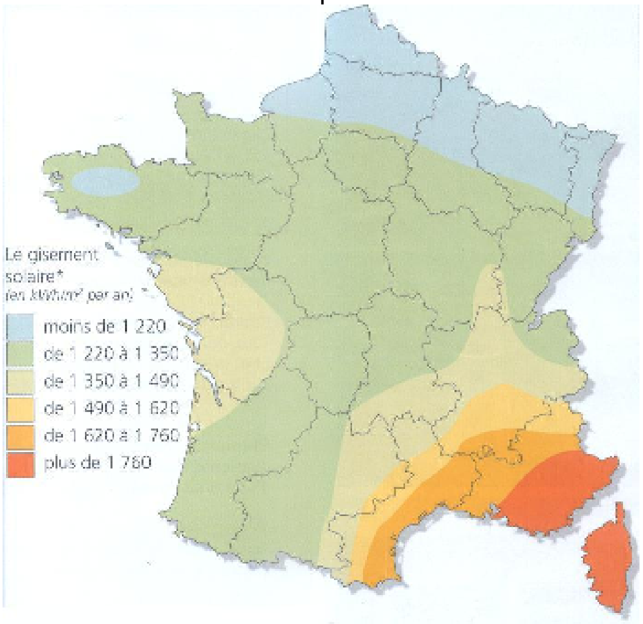
Average temperature in France

Map 2



The solar average radiation

Map 3



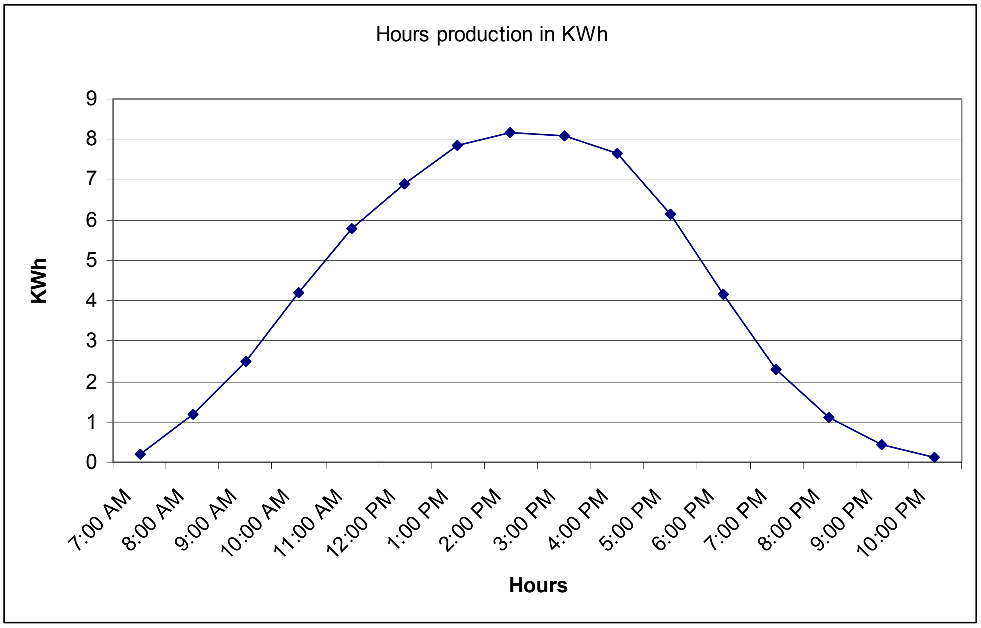
d. Solar Potential

i. Available hours

These sunshine hours are the amount of full sun hours. Indeed, the solar panel is not always facing the sun, because the earth moves non-stop and because the slope of the sun with regard to the panel changes constantly. During a day without clouds, electricity production by the panel also varies constantly according to the sun's position and is never at its maximum except at the brief passage of high noon. The production at the end of the day is thus a sum of many partial productions. Even with a cloud cover, that is, in the absence of sun, the ambient luminosity, with the sun hidden, allows the same but a much smaller electricity production, and these small productions eventually make total kWhs. At the end of the year, from the total electricity produced, we obtain the number of full sun equivalents for the year, which has nothing to do with the number of sunshine hours in the meteorological sense.

We can see on this graph below, the electric production of each solar panel. At noon, the sunshine is at its maximum; the electric production is the highest.

Graph 8



ii. Solar Photovoltaic's Slope

There is an ideal position for a solar panel: the fully south facing solar panel with a slope of 30° with regard to the horizontal. And then there is reality which obliges us to work with the architecture of the building and the presence of shadows from trees, bell towers, buildings towards, etc. A tolerance is thus accommodated: the solar panel must be directed between southeast and southwest and the slope of between 20-50° with regard to the horizontal.

The solar panels must be perpendicularly placed with regard to the sun to obtain an optimal result. The adjustment on the vertical plan requires knowing the trajectory of the sun, according to the season and to the geographical place.

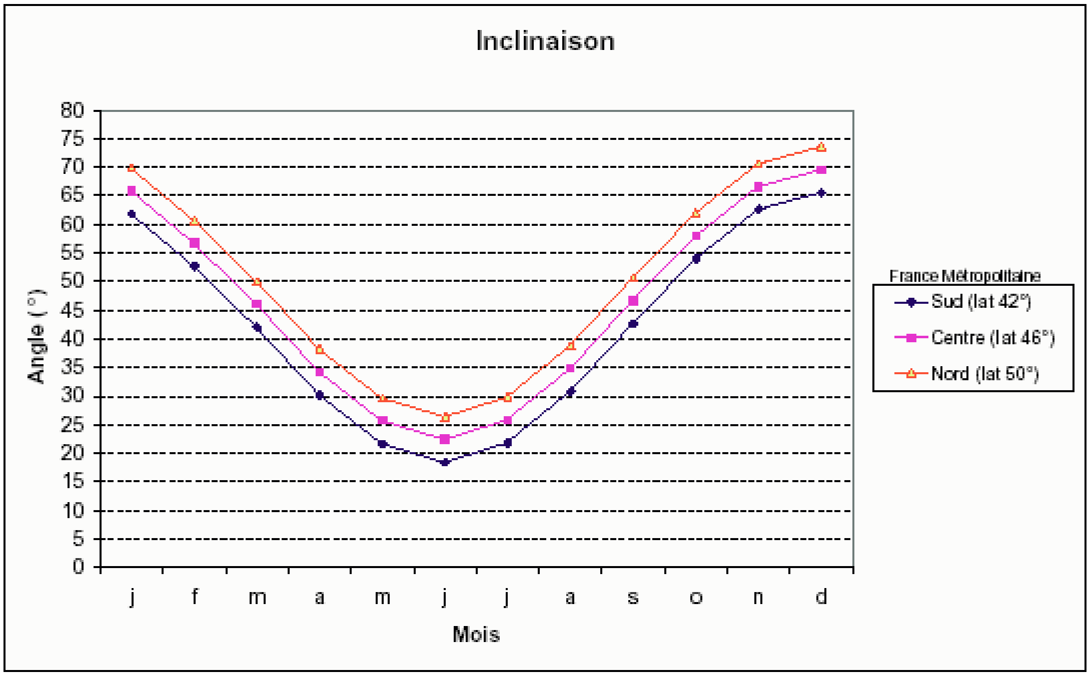
The slope of the solar panels with regard to the horizontal is given by the following relation:

Slope = (latitude of the place) – Arcsinus (0,4*Sinus*(N.360/365))

With N, the number of day between the spring equinox and the day considered.

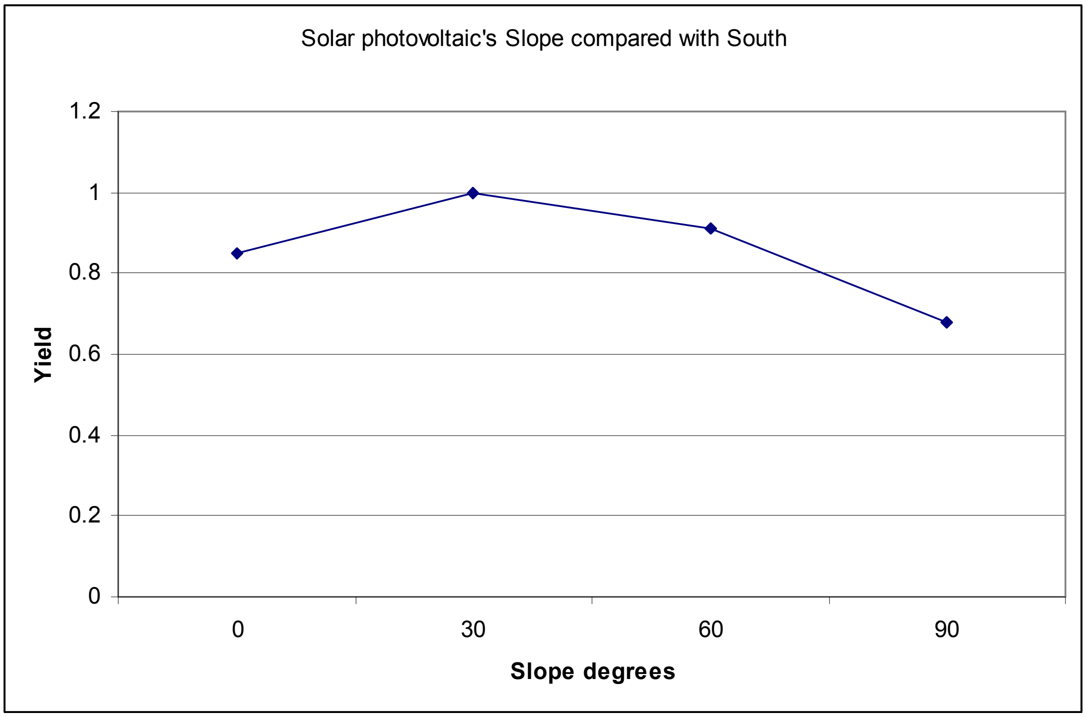
The slope angle variation for France

Graph 9



On the graph below, we see the yield according to the incidence slope. We see that we have a better yield if we orient the solar panel at 30 degree from sun.

Graph 10



iii. Shade

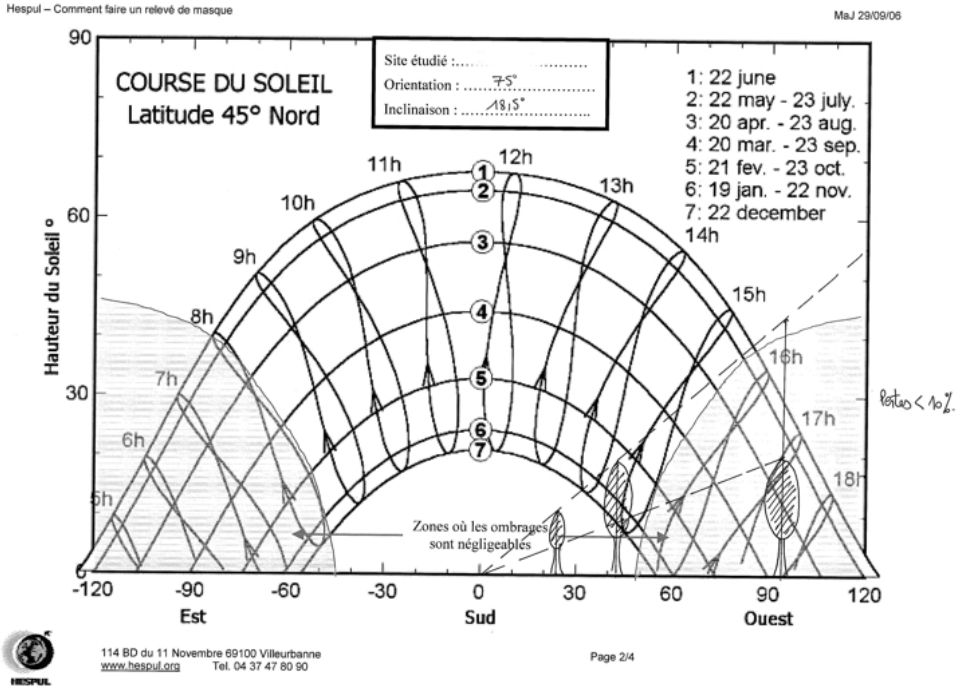
The photovoltaic sensor is very sensitive to shade. Contrary to the thermal solar panels which can tolerate a little shade, the photovoltaic sensor can't be darkened, mainly because of the electric connections between the cells and modules.

Shade on the photovoltaic sensors comes from many sources: a tree, a building or the natural contour of an area. A loss of production and the impact of the shade are more or less important based on the size of the obstacle and especially its height. That is why it is best to quantify this aspect before investing in the installation of panels.

We can see on the graph below, there is no shade between 8:00 am and 3:30 pm, and these are the best hours to produce electricity. Most of the time, the photovoltaic cells are connected in mass. So, the weakest cell is going to determine and limit of power of the other cells. A shade of half of each cell will decrease the power proportionally to the percentage of the shaded surface of the cell, in this case 50%. Total shade of a row of cells reduces the cell power to zero.

If we think that any place will be subject to a lot of shade, we must consider that elevated shade in using this graph below:

Graph 11



iv. Temperature of operation

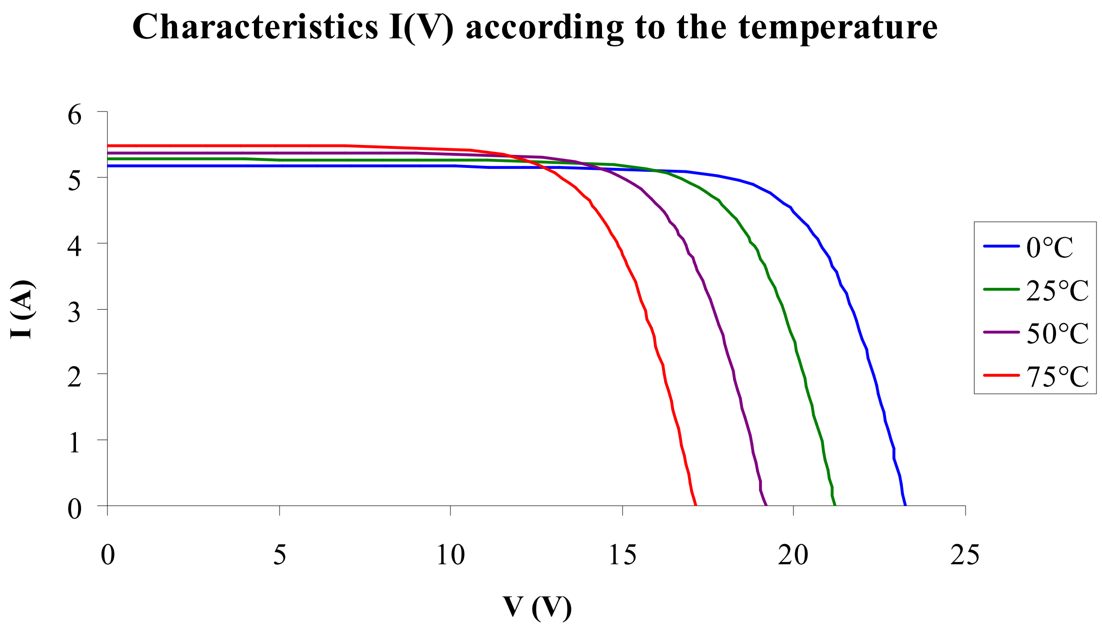
Two parameters are important for the production of current by means of photovoltaic panels:

- The sunshine
- The temperature

Finally, temperature affects operation. A study showed that when the temperature increases in the case of cells in the silicon, the current increases about 0,025 my / cm2 / °C while the tension decreases of 2,2 mV / °C, consequence of a loss of power about 0,4 % / °C. Thus, the more the temperature increases, the less the cell is successful. The ideal temperature is between 22 and 25 °C for the best yield.

We can see the decrease in current as a function of temperature on Graph 12 below.

Graph 12



It is very important to refresh solar panels in order to improve the yields. In order to make energy saving, several people use domestic water for cooling the water panels, thus avoiding the boiler.

III. Warehouse studies

Warehouse roofs are a huge unexploited area for photovoltaic installation. Often warehouses are built in the suburbs, far from the city, buildings, and any other construction. So, warehouse roofs are not shaded, or only a little, and are perfect for installation of solar photovoltaic panels. Instead of installing fields of solar panels on the ground, why not install solar photovoltaic panels on our buildings? This study explores this concept, including the available surfaces on the warehouse roofs in France, the amount of available annual sunshine, and the electricity production from the potential installed power.

a. France's most important warehouses

In France, only 3 principal warehouse areas exist:

- The North of France (Dunkerque, Lille, …)
- The Region of Paris
- The South of France (Marseille, Perpignan, Aix en Province, …)

In these areas, 48 warehouses are available. The Region of Paris is a significant location, more than the North or the South in terms of number of warehouses. The available warehouses in the 3 regions are listed below.

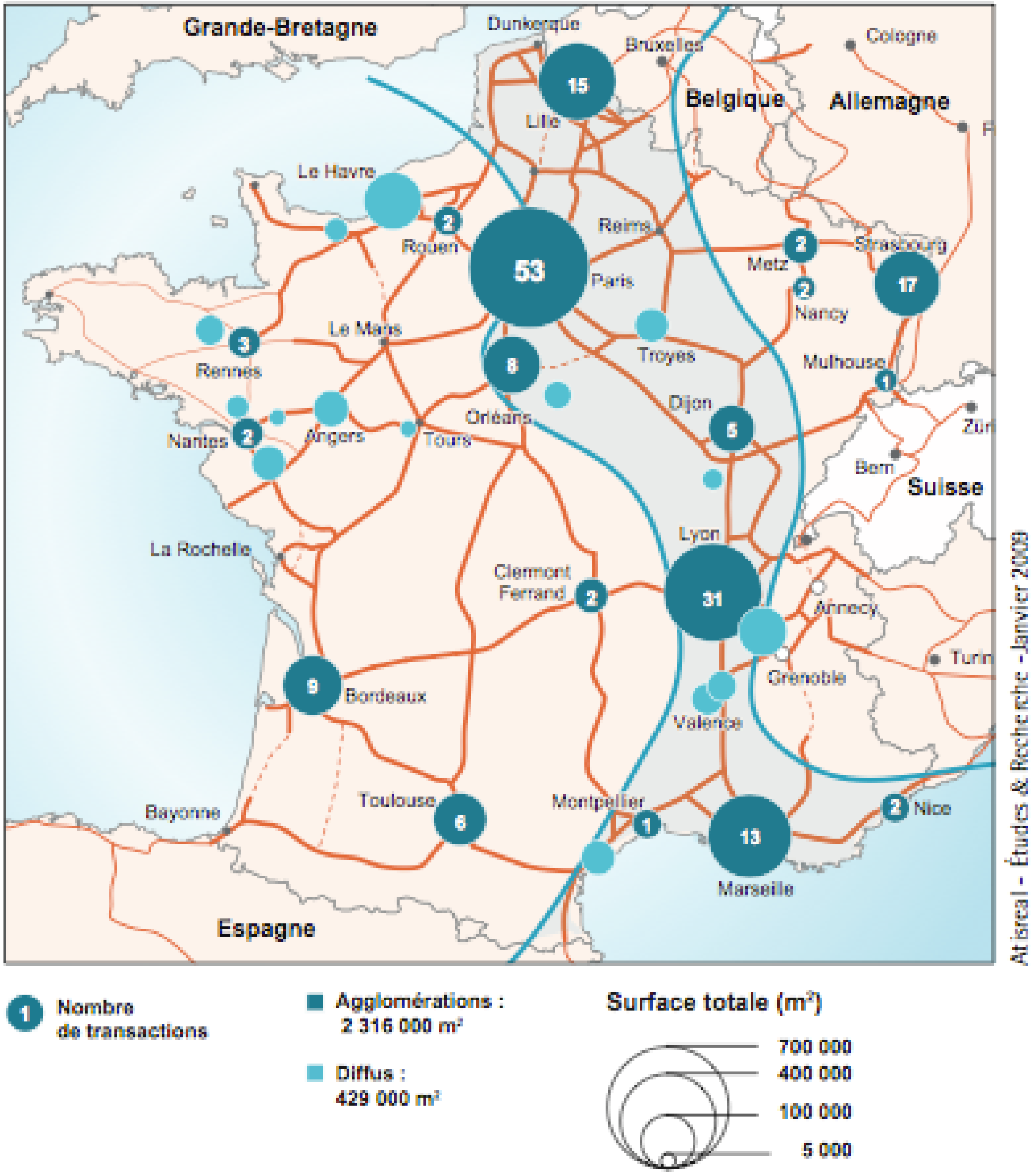
Table 1

	Warehouses Available
North of France	9
Region of Paris	23
South of France	16
Total	48

This study is based on these 48 warehouses, with an average surface area of 28 900 m^2, with the exception of 5 warehouses with more than 100,000 m^2. The total surface of these warehouses is 3,582,087 m^2 without shade or encumbrances (air conditioning, chimney, etc). With shade and obstacles for each warehouse, the total surface available is 1, 970,147.85 m2. This is the available space for installing solar panels on their roofs.

We can see on this map below the most important aggregate areas in France for this proposal. The west of France does not have any important warehouses. The more important warehouses are situated near the European border.

Map 4: European border



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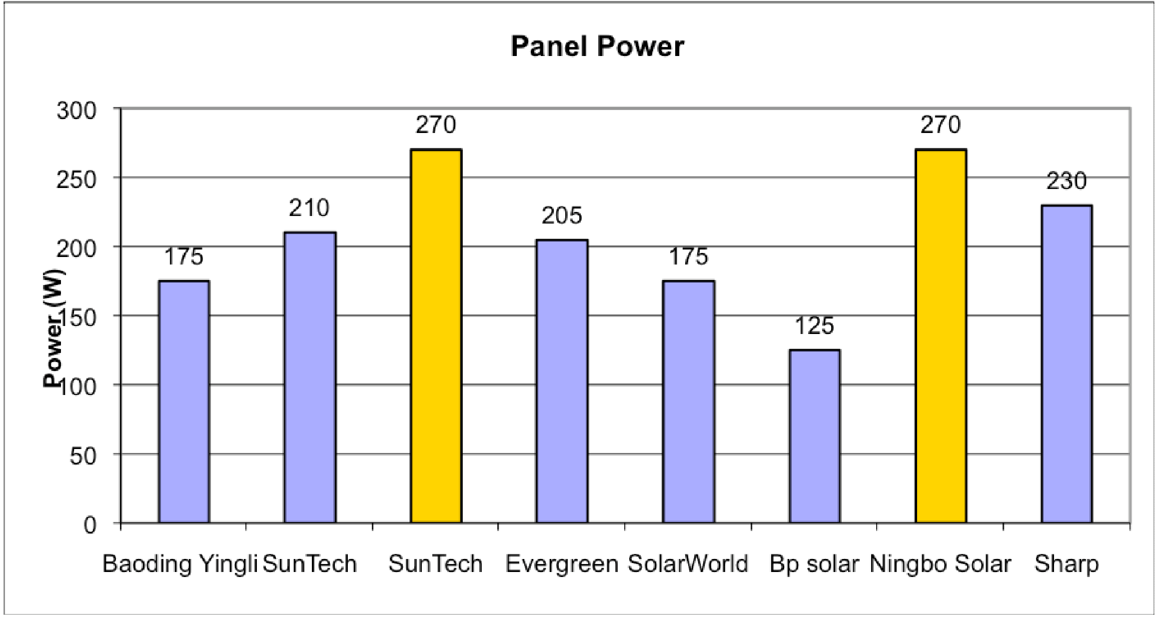
b. Yield: Installed Peak and Electricity production per year

i. Photovoltaic panel used

For this study, it was necessary to choose one type of solar panel to be the most exacting. Any number of solar panels could be installed. Several types of cells were surveyed, but it is clear from the graph below that SunTech and Ningbo Salor had the best power production compared to the other photovoltaic panels. The choice between these two solar panels was arbitrary.

Graph 13



The SunTech solar panel is a polycrystalline cell type. The SunTech surface is 1,94m^2 and has a peak power of 270 watt.

ii. <u>Online software used: PVGIS</u>

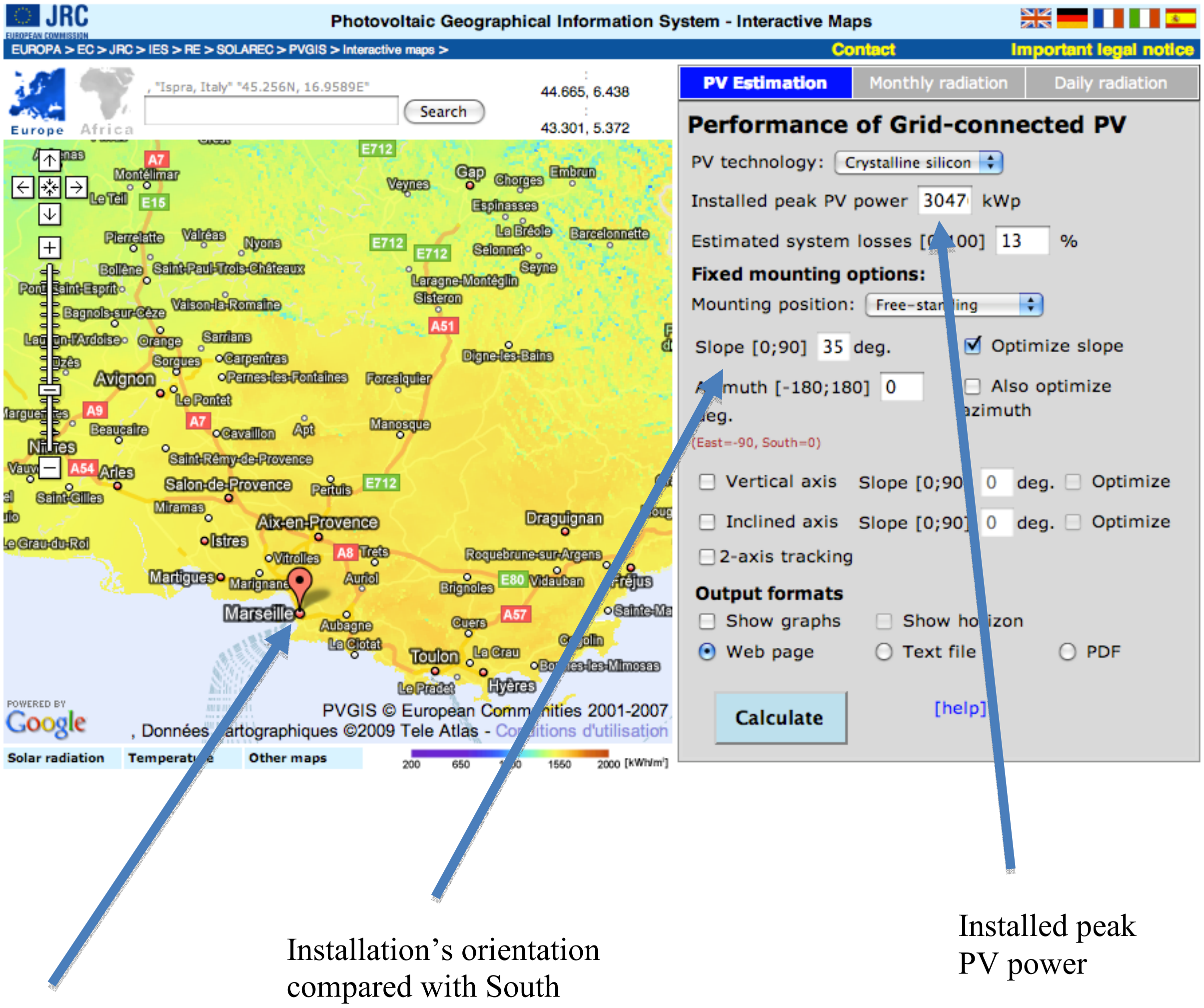
Photovoltaic Geographical Information System (PVGIS) provides a map-based inventory of solar energy resources and an assessment of the electricity generation from photovoltaic systems in Europe, Africa, and South-West Asia. It is a part of the SOLAREC action that contributes to the implementation of renewable energy in the European Union as a sustainable and long-term energy supply by undertaking new S&T developments in fields where coordination is required and requested by customers.

After defining the surface available, without shade and encumbrances, the installed peak power was defined based on the photovoltaic panels' power and its surface. The most important point to define is the warehouses' orientation to the south. PVGIS is useful in calculating the yield based on the difference in angle with the south.

On PVGIS online, we put the cursor on the map to define the warehouse localization; this map is based on Google Map. After filling in the various fields for installation, the peak power by years and the orientation with regard to the South, PVGIS calculates the installation's yield. The picture below is an example of PVGIS software online.

Here we picked Marseille as our localization with an installed peak photovoltaic power of a 3047 KWp (Kilowatt peak). To optimize this installation, PVGIS knows the panel’s slope according to its geographic location.

Map 5



Performance of Grid-connected PV

PV technology: Crystalline silicon

Installed peak PV power 3047 kWp

Estimated system losses [0;100] 13 %

Fixed mounting options:

Mounting position: Free-standing

Slope [0;90] 35 deg. ☑ Optimize slope

Azimuth [-180;180] 0 deg. ☐ Also optimize azimuth

(East=-90, South=0)

☐ Vertical axis Slope [0;90] 0 deg. ☐ Optimize

☐ Inclined axis Slope [0;90] 0 deg. ☐ Optimize

☐ 2-axis tracking

Output formats

☐ Show graphs ☐ Show horizon

● Web page ○ Text file ○ PDF

Calculate [help]

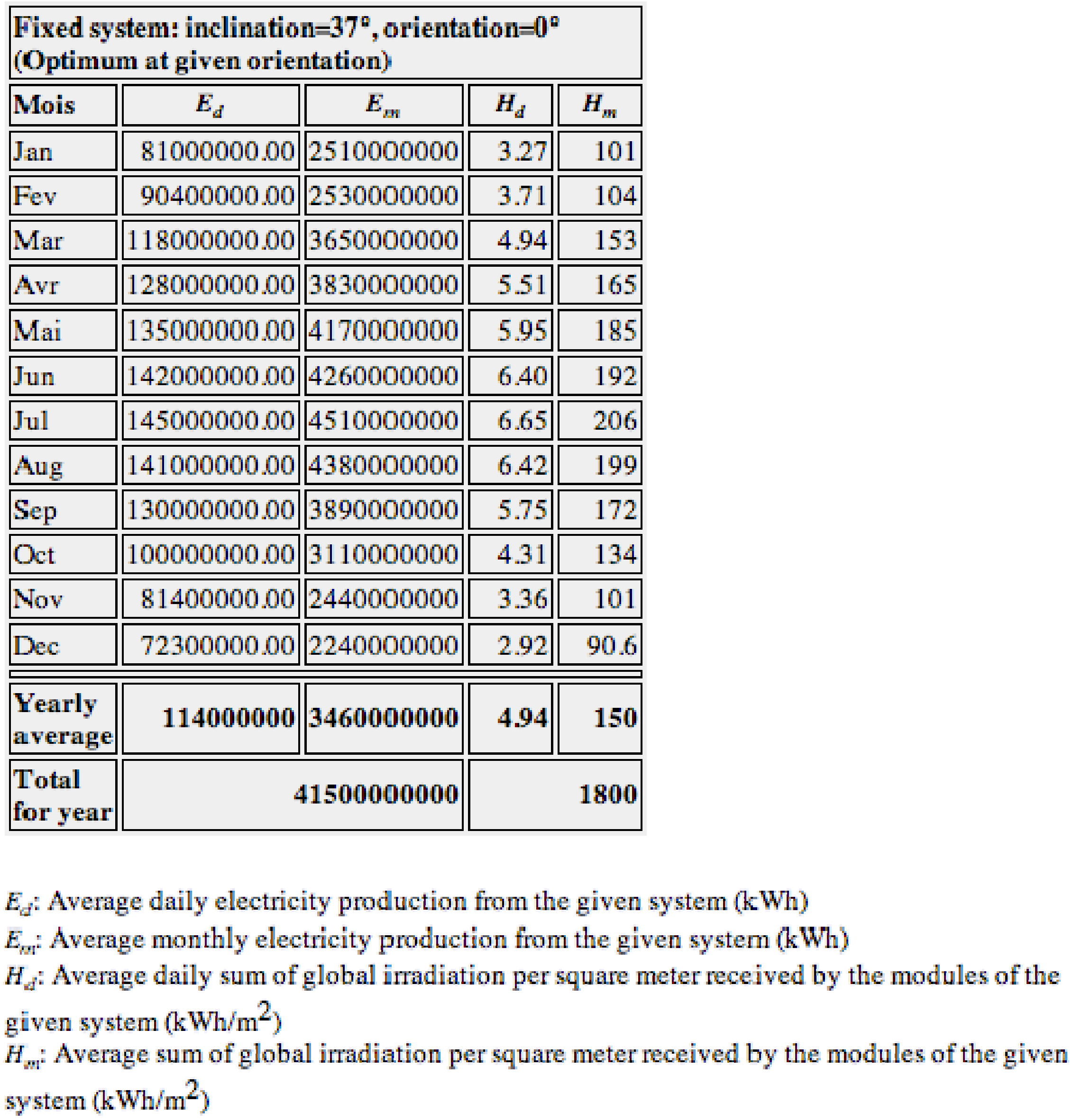
Installation’s localization

Installation’s orientation compared with South

Installed peak PV power

In this second picture below, PVGIS calculates the performance of this installation. The end of this chart, the power production in KWh and the irradiation in KWh/m2 is of interest to us.

Table 2



Fixed system: inclination=37°, orientation=0°
(Optimum at given orientation)

Mois	E_d	E_m	H_d	H_m
Jan	81000000.00	2510000000	3.27	101
Fev	90400000.00	2530000000	3.71	104
Mar	118000000.00	3650000000	4.94	153
Avr	128000000.00	3830000000	5.51	165
Mai	135000000.00	4170000000	5.95	185
Jun	142000000.00	4260000000	6.40	192
Jul	145000000.00	4510000000	6.65	206
Aug	141000000.00	4380000000	6.42	199
Sep	130000000.00	3890000000	5.75	172
Oct	100000000.00	3110000000	4.31	134
Nov	81400000.00	2440000000	3.36	101
Dec	72300000.00	2240000000	2.92	90.6
Yearly average	**114000000**	**3460000000**	**4.94**	**150**
Total for year		**41500000000**		**1800**

E_d: Average daily electricity production from the given system (kWh)
E_m: Average monthly electricity production from the given system (kWh)
H_d: Average daily sum of global irradiation per square meter received by the modules of the given system (kWh/m^2)
H_m: Average sum of global irradiation per square meter received by the modules of the given system (kWh/m^2)

In appendixes 2, we can see the chart with all warehouses, installed peak power, unit panels installed and PVGIS's study of each warehouse.

At the end, we have a study with 48 warehouses for an installed peak of 274,133 MWp (Mega Watt peak), and an electricity production of 117,925 GWh per year.

iii. Photovoltaic yield

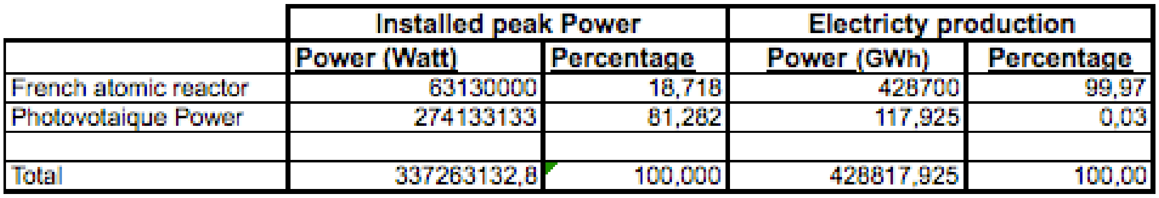
With the PVGIS study, it was possible to derive the photovoltaic yield of these warehouse installations. In order to compare the photovoltaic study with another electricity source, it was easiest to compare it with that of nuclear power.

Nuclear power in France is 63.13 MWc of installed peak power, and this installation produces 428,700 GWh of electricity.

The real difference between nuclear power and the photovoltaic power is production time. Sure enough, the nuclear reactor can produce all day without stopping, and it doesn't have a problem with the weather forecast, shade or anything else.

On the chart below, we can see the comparison of electricity production between these two productions. Eight times more installed power is needed with the photovoltaic power to produce just 0,03% of the nuclear power!

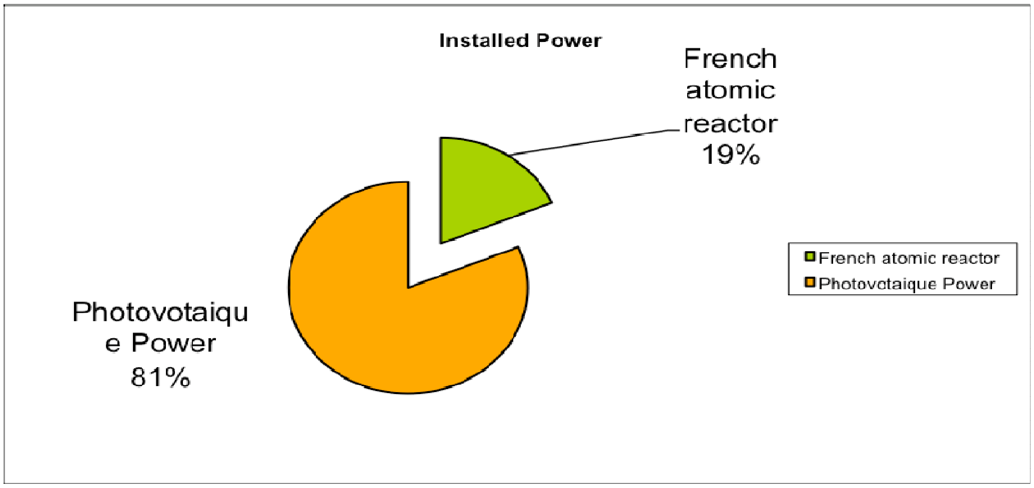
Table 3 **Installed Power and electricty producted**



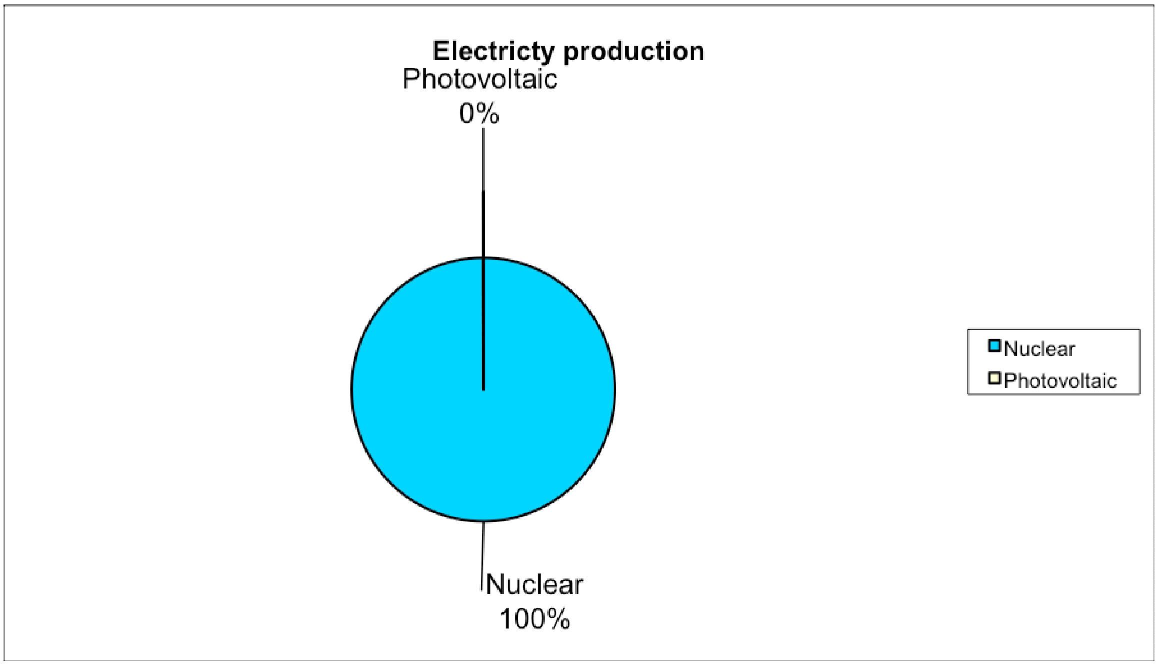
	Installed peak Power		Electricty production	
	Power (Watt)	Percentage	Power (GWh)	Percentage
French atomic reactor	63130000	18,718	428700	99,97
Photovotaique Power	274133133	81,282	117,925	0,03
Total	337263132,8	100,000	428817,925	100,00

On the graph below, we can see the importance of the installed power. To produce 117,925 GWh with the photovoltaic technology, we would need to install 81% more photovoltaic power than nuclear power.

Graph 14: Difference of installed peak power: nuclear power vs. photovoltaic power.



Graph 15 Difference of electricty production between photovoltaic and nuclear



We can see from both graphs above, the difference between the installed peak power and the electricity production for both technologies. The first graph shows the huge quantity of photovoltaic that would need to be installed to produce a small quantity of energy. On the second graph, the yield difference between nuclear and photovoltaic is quite stark. When we install 19% of electricity power from nuclear, nuclear power furnishes 100% of the electricity production for France.

<u>Why nobody installs central photovoltaic on his roof?</u>

Seed capital essentially establishes the cost of a photovoltaic plant. Indeed, the solar energy (the input) that is exploited is free and healthy. Solar panels count for 60% of the invoice cost, the uninterruptible power supply for 15%, and the elements of assembly and installation for 25% in an installation connected to the network.

In France, an autonomous installation, Wc cost between 20 and 30 € (including price of battery). FACE (Amortization fund of the loads of electrification) finances a big part of these autonomous installations in the rural environment. ADEME and regional councils subsidize in urban regions. Grants brought by the ADEME amount to 4,6 € / Wc installed with a ceiling of 2,5 kWc. In the end, the private individual pays 5 to 50 % of the installation in urban zones and 5 in 13 % of the installation in rural areas.

However, the autonomous installations can only produce enough energy to meet the household need if there is battery storage on-site. Nearly all solar installations on homes and commercial buildings are connected to the gird which acts as the "battery" for nighttime needs. Today in France, electricity is not very expensive and thus slows down the acceptance and installation of solar panels.

What is the different environmental impact between nuclear and photovoltaic?

From photovoltaic:

The manufacturing of the photovoltaic cells requires heavy industry (mainly for the manufacturing of the silicon). The processes used in the solar energy are close to those used in the microelectronics. Numerous years of experience are required in this industry at the level of the safety and of reprocessing of the waste. Energy is consumed, thus CO_2 is produced, but no other pollution was listed. Part of the craze for photovoltaic electricity is due appropriately to the issue of sustainability and in valuing clean energy. The enormous advantage of photovoltaic panels is that, according to the manufacturer, it can produce some electricity over ten years in extreme conditions (rain, hail, frost) without maintenance and without producing the slightest pollution. For PV panels based on silicon, even if its glazed surface breaks (falls), it doesn't result in pollution.

Panels based on a silicon cell can be recycled. There is a German company which owns a production line to extract the glass, the frame and the silicon panels that can be reused to make new photovoltaic panels.

From nuclear:

The real danger with the nuclear energy is the radioactive waste. Indeed, it's a real problem, because it's so difficult, or impossible, to dispose of this waste which is extremely toxic to the environment and dangerous to humans. This waste is much more polluting than the silicon from solar panels. Nuclear waste must be controlled, contained and stored in a secured site to decrease the environmental impact and risk to human life.

Conclusion

The photovoltaic technology is a new energy option for France. Many people install photovoltaic panels on their roof and sell the electricity produced back to EDF. It's a new technology, a great technology for the future.

But, as we can see in this report, today this technology hasn't replaced nuclear or any other source of production. It is a viable alternative. All European countries subsidize photovoltaic technology. Solar advocates know that as yet, this technology has not gained widespread development and is not as successful as one would wish. The principal problem with the photovoltaic panels is the yield; it is very low, just 13% or, at best, 15% and works just 40% of the day, between 7:00 am and 5:00 pm. Nuclear technology is still more competitive, as it can run 24/7.

Many people are working on future photovoltaic technology with a higher yield, seeking 50% efficiencies with nanotechnology. If this technology exists in the future, producing electricity with photovoltaics would be productive and more competitive. Maybe then we would change our electricity sources.

In this report, we have seen that is possible to install a huge photovoltaic farm on French warehouse roofs and to produce much electricity. However, it is not a lot compared to nuclear power but sufficient to reduce our electricity consumption and so, our CO_2 emissions.

Finally, everybody thinks well of photovoltaics. They are good equipment to install on one's own roof. With the ability to resale electricity to EDF, an installation of 2940 Wc is profitable at the end of 6 years (when we deduct the tax credit); after that, it's a new source of income! But given the photovoltaic installations today, as good as they are, we still need other electricity sources, such as nuclear, fossil, or other renewables like hydropower, wind and geothermal energy.

Appendices

Appendices 1: Website Bibliography

Roof Top :
http://www.phila.gov/prisons/docs/fact%20sheet%20for%20jail%20based%20solar%20project.pdf

Nuclear in France ;
http://www.algerie-dz.com/forums/archive/index.php/t-49738.html

Solar panels :
http://www.siliconsolar.com/solarpanels.php
http://www.pvpower.com/solarpanels.aspx
http://blog.gogreensolar.com/
http://www.soda-is.com/eng/map/france_2006_dni_en.html
http://energycenter.org/index.php
http://images.google.com/imgres?imgurl=http://pagesperso-orange.fr/herve.silve/images/graph_solaire.gif&imgrefurl=http://pagesperso-orange.fr/herve.silve/solaire.htm&usg=__FvoAuqatohlT6vbjXCYAy0AxFN8=&h=294&w=531&sz=10&hl=en&start=8&sig2=GO_St8E-mqGZ1btgWL_N5g&um=1&tbnid=-bVvnpIsXYdYgM:&tbnh=73&tbnw=132&prev=/images%3Fq%3Drayonnement%2Bsolaire%2Bfrance%2Bgraph%26hl%3Den%26sa%3DG%26um%3D1&ei=0l4pSqrbIpnksgPV5qD0Cg

Pdf reports:
200710291659110.photovoltaique.pdf (Ademe report)
Atisreal-entrepots-France-eFlash-01_2009.pdf
FicheSER_photovoltaique_02_chiffresFR.pdf\
Marche_du_solaire_Nov2008.pdf
Oblog-Etat_du_Parc_Immobilier_Logistique_en_France.pdf
Prés%20invest%20énergie%20CDC%20Ch%20Agric%20Troyes%20%2021avr2009.pdf
Solaire_Vallorbe.pdf
surface entrepot sud.pdf
Trusteesofreservation_Final Report.pdf
Zoom Filière Transport&Logistique BdR_2007.pdf

Appendices 2: Warehouse studies

	Warehouses in France					With PVGIS	
Localisation	Total Surface (m2)	Surface with Shade (m2) and cover [illegible]	Orientation compared with south (in degrees)	[illegible] peak PV power [illegible]	[illegible]	Electricity production per year (GWh)	global irradiation per square meter [illegible]
South Of France							
Marseille Airport	40000	20000	60	3061030	11007	3,58	540
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Parc d'activité de la Crau Salon de Provence	250000	[illegible]7500	20	10[illegible]2865	70562	1,57	750
UPS Marseille	40000	20000	35	3061030	11007	3,00	710
Saint Martin de Crau	360000	[illegible]8000	10	22551432	60842	3,60	750
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] Marseille	270000	[illegible]5000	60	[illegible]1657	72030	1,56	650
ZAC les Molières [illegible] Provence	[illegible]	20400	0	154990	1055	0,02	620
Zone de la [illegible] Montpellier	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] Marseille	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Zone de la [illegible]	[illegible]	527,55	20	57054	324	1,15	610
[illegible] Provence	965	406,75	30	5748	250	0,027	750
PIL [illegible] Montpellier	[illegible]	8440	10	403760	1454	5,10	710
North Of France							
Decathlon [illegible]	30 000	12500	15	268705	6803	1,02	1140
[illegible]	300 000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	600 000	240000	10	4515023	7867	4,05	1140
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] Arras	40000	20000	10	3061030	11007	2,71	1150
[illegible] Château [illegible]	31000	17350	10	2712030	8755	3,00	1140
[illegible]	17200	3510,5	0	[illegible]2559	4032	1,17	1140
Saint Martin [illegible]	155[illegible]	103850	10	[illegible]0052	5341	2	1170
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Region Of Paris							
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] Paris Oise	30357	7752,55	0	2478032	5171	2,2	210
Brie Comte Robert	20744	105902	0	740255	6445	1,71	250
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] Pont	58450	30502,45	5	4244[illegible]46	15779	4,21	[illegible]00
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	43219	25400,45	10	3538035	12[illegible]00	3,5	[illegible]00
[illegible]	30000	17500	0	2445770	5073	1,67	240
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	45500	25325	10	3461030	10556	3,46	250
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	22006	11650	10	952709	5255	1,06	240
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	40425	22233,75	0	3062557	11455	3,32	240
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	32300	15[illegible]50	5	2525332	9250	1,74	250
[illegible]	1150	5155,5	10	685262	3171	0,56	240
[illegible]	30700	6850,55	0	2140057	6734	1,67	250
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	24341	[illegible]717,55	0	905527	7050	2	240
Total	3592027	1070147,35		274133153		117,325	56660