



TOTAL


**A NEW ENERGY FUTURE
WITH SOLAR ENERGY**





AN **AMBITIOUS,** LONG-TERM **COMMITMENT**


SOLAR ENERGY – **ABUNDANT, CLEAN AND RENEWABLE** – IS BECOMING MORE EFFICIENT EVERY DAY. HERE AT TOTAL, WE ARE ACTIVELY PREPARING THE FUTURE BY STEPPING UP OUR ONGOING INVESTMENT IN SOLAR POWER, A CRITICAL COMPONENT IN THE WORLD'S SUSTAINABLE ENERGY SUPPLY.



For 30 years, specialists at Total and in our subsidiaries have helped drive progress across the photovoltaic solar energy chain, fostering the emergence of a reliable, efficient and cost-effective technology.

In 2011, by becoming the majority shareholder of SunPower, one of the world's leading solar energy operators, Total has given new impetus to its development. A major change in scale, with a key ambition: to become a new world leader in solar energy.



 Our strengthened commitment is underpinned by a belief, a real credibility and a strategic vision. The belief that photovoltaic energy will soon fulfill its promise and become a key driver of the energy transition that society has to successfully implement in the coming decades. The credibility conferred by our recognized solar expertise and our position as an energy company. And a strategic vision that the solar energy industry requires significant

human, financial and technological resources to improve efficiency, lower costs and diversify applications, bringing it to commercial maturity. Total is one of the companies capable of harnessing these resources and becoming an international solar energy operator. Organic asset growth, new industrial partnerships, research and innovation are the solid foundations on which we are building a long-term, profitable solar energy business.



SUNPOWER: THE FOCAL
POINT OF OUR PHOTOVOLTAICS
COMMITMENT



SUNPOWER

MORE ENERGY. FOR LIFE.™

In June 2011, following a friendly takeover bid, Total became the majority shareholder of U.S.-based SunPower, one of the world's leading solar energy operators. We now hold a 66% stake in the company. This agreement represented a major milestone in the deployment of our solar strategy. Backed by Total's financial strength and international footprint, SunPower is now at the center of our solar energy business.

SunPower has been developing high-efficiency photovoltaic technologies for 30 years. A Silicon Valley pioneer, it has gradually carved out a niche for itself as one of the world's leading solar energy specialists, in large part because of the reliability of its solutions.

SUNPOWER AT A GLANCE:

MORE THAN

5000 EMPLOYEES

OPERATIONS IN **16** COUNTRIES,
HEADQUARTERED IN SAN JOSE,
CALIFORNIA

2,4 BILLION
REVENUE IN 2012

2,5 GW
OF INSTALLED
POWER OVER THE
PAST FIVE YEARS

- SunPower is fully integrated across the entire value chain, from solar cell production to turnkey development of large-scale solar power plants and installation of residential rooftop solutions.
- SunPower manufactures all its cells in Asia (The Philippines and Malaysia). SunPower also has five solar panel assembly plants (The United States, Mexico, The Philippines and France).



SUNPOWER'S MODULE ASSEMBLY FACILITY
DE VERNE JOUL, FRANCE.

SunPower is active in rooftop solutions for **residential, industrial and commercial buildings** in the United States, Europe and Asia. It has also focused on **turnkey construction of solar power plants** for close to ten years, delivering nearly 2.5 GW of installed power over the past five years.



CALIFORNIA VALLEY SOLAR RANCH COMMISSIONED IN OCTOBER 2013.

GIANT SOLAR FARMS IN CALIFORNIA

Solar Star

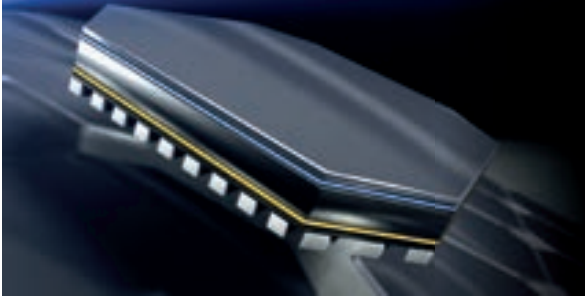
SunPower is currently developing the largest solar photovoltaic project in the world: Solar Star, located in Rosamond, California (USA). The construction of the two ground-mounted solar photovoltaic systems started early 2013. The whole project will total an amount of 709 MWdc (579 MWac), and will comprise 1.7 million SunPower high efficiency panels, the equivalent of the annual consumption of 400,000 households.

California Valley Solar Ranch

SunPower developed one of the largest solar farms in the world, the California Valley Solar Ranch (CVSR), with total installed power of 315 MWdc (250 MWac). Commissioned in October 2013, the 800,000 SunPower high-efficiency panels produce clean and renewable energy for the State of California.

21.5%

SUNPOWER: THE WORLD'S MOST EFFICIENT PANELS



With a 21.5% efficiency, SunPower panels hold the world's efficiency records.

With 24.2% efficiency, SunPower's Maxeon™ cells are up to 50% more efficient than conventional cells, which perform at around 16% efficiency. Maxeon™ cells capture more sunlight because they are made of high quality monocrystalline silicon and because all wiring is located on the back.

SunPower panels based on Maxeon™ technology provide exceptional efficiency in all conditions, including extreme temperatures and overcast skies. They are the most elegant and efficient panels in the world, with a sleek design that is perfect for roofintegrated systems.



The San José-based firm has a wide range of products to meet customers' specific needs. In addition to solar installations, SunPower offers a monitoring system that sends real-time data to SunPower maintenance.

Maxeon™ technology combined with quality design ensures the highest level of reliability. SunPower backs its technology with a solid 25-year warranty—the most effective in the industry—covering both parts and panel performance.

SUNPOWER®

MORE ENERGY. FOR LIFE.™



A GLOBAL INTERNATIONAL FOOTPRINT

for solar power plants, residential and commercial rooftop,
and for the offgrid business.

Modules
Vernejoul, France

Cells & modules
Batangas & Laguna, Philippines

Cells
Melaka, Malaysia

- Corporate headquarter
 - *EMEA APAC headquarter
 - ★ Factories
 - ▲ Main power plant projects
 - ★ Distribution network (partnerships in Japan)
- *EMEA : Europe, Middle-East, Africa
APAC : Asia Pacific





SOLAR R&D: INVESTING TO IDENTIFY THE MOST EFFICIENT TECHNOLOGIES

SOLAR ENERGY R&D FOCUSES PRIMARILY **ON OPTIMIZING CELL PRODUCTION**, THE KEY LINK IN THE PHOTOVOLTAIC CHAIN.



CUTTING COSTS ON STORAGE

Solar energy is intermittent. To allow the broadest possible use, efficient solutions are needed to store this energy and ensure it is available when needed. **A five-year, \$4-million contract signed with the Massachusetts Institute of Technology (MIT) in 2009 will help our researchers develop a**

highly efficient, low-cost, long-life battery. In late 2010, encouraged by the project's very promising results, the partners decided to create a start-up, LMB Corp. (Liquid Metal Battery Corporation), which then became "AMBRI", to develop these grid-scale energy storage systems.

The objectives are to reduce costs more quickly, increase the conversion efficiency of existing and future components, and expand applications. This process marshals the wide array of expertise available across Total, in close collaboration with leading science and research organizations. Total has signed a number of partnership agreements recently with globally recognized research centers, including:

LAAS: (Laboratory for Systems Analysis and Architecture - Toulouse, France) to enhance the efficiency of photovoltaic modules using a systemic approach.

IMEC: (Interuniversity MicroElectronics Center - Louvain, Belgium) to decrease the amount of silicon needed for cells and improve their efficiency.

LPICM: (Interface and Thin Film Physics Laboratory - Saclay, France), a joint research facility of the French National Center for Scientific Research (CNRS) and the Ecole Polytechnique engineering school with a combined team working on crystalline silicon thin film technology.

Solar R&D center Institut Photovoltaïque d'Ile-de-France (IPVF)



Total is partner of the project **IPVF, one of the five largest centers worldwide conducting research into new generation photovoltaic solar systems.**

In October 2013, the IPVF and the French National Research Agency (ANR) have signed a six-year, €18.5 million financing agreement that allows the institute to start operating and endorses the content of its scientific programs.

Based in Saclay, France, Total is partner alongside French National Center for Scientific Research (CNRS) and Ecole Polytechnique, associated with Air Liquide, Horiba Jobin Yvon and Riber.

In 2016, the Institute expects to have nearly 200 researchers.



TOTAL SERVICE STATION, IN THE REUNION ISLAND.



TOTAL SITES, AMBASSADORS FOR PHOTOVOLTAIC POWER

TOTAL IS INTEGRATING PHOTOVOLTAIC SOLAR SOLUTIONS INTO SOME OF ITS EXISTING INDUSTRIAL AND COMMERCIAL INFRASTRUCTURE.

FACADE OF THE CSTJF BUILDING IN PAU, FRANCE.



SINCE 2010, TOTAL INSTALLS SOLAR PHOTOVOLTAIC SOLUTIONS ON ITS PREMISES AND ITS SERVICE STATIONS NETWORK, IN FRANCE, IN EUROPE AND IN AFRICA.



TOTAL SERVICE STATION IN LE HAVRE.

Total's first equipped sites are both located in the south west part of France, in Pau and in Lacq.

- The Pau site has a production capacity of 230 MWh/year and a land footprint of about 2,400 square meters of solar panels.
- The Lacq site's 4,450-square-meter footprint has a production capacity of around 410 MWh/year.

Total intends to promote the installation of SunPower rooftop solar panels at service stations around

the world, within its existing network and especially at new stations. The panels, which can be installed on shop roofs or integrated in canopies, will offer an annual production capacity of 35-50 MWh depending on the geographic location.

In 2013, around twenty new Total service-stations have been equipped with solar panels, mostly in Europe and in Africa. The goal is to roll-out the solution more widely in Africa during 2014.

SHAMS, ONE OF THE WORLD'S LARGEST CONCENTRATED SOLAR POWER PLANTS



SHAMS AT A GLANCE: 100 MW OUTPUT POWER

2,5 KM² AREA, EQUIVALENT TO
285 FOOTBALL FIELDS

258,000 PARABOLIC TROUGH COLLECTORS

20,000 UAE POWERED HOMES

175,000 TONS OF CO₂/YEAR WILL BE
DISPLACED

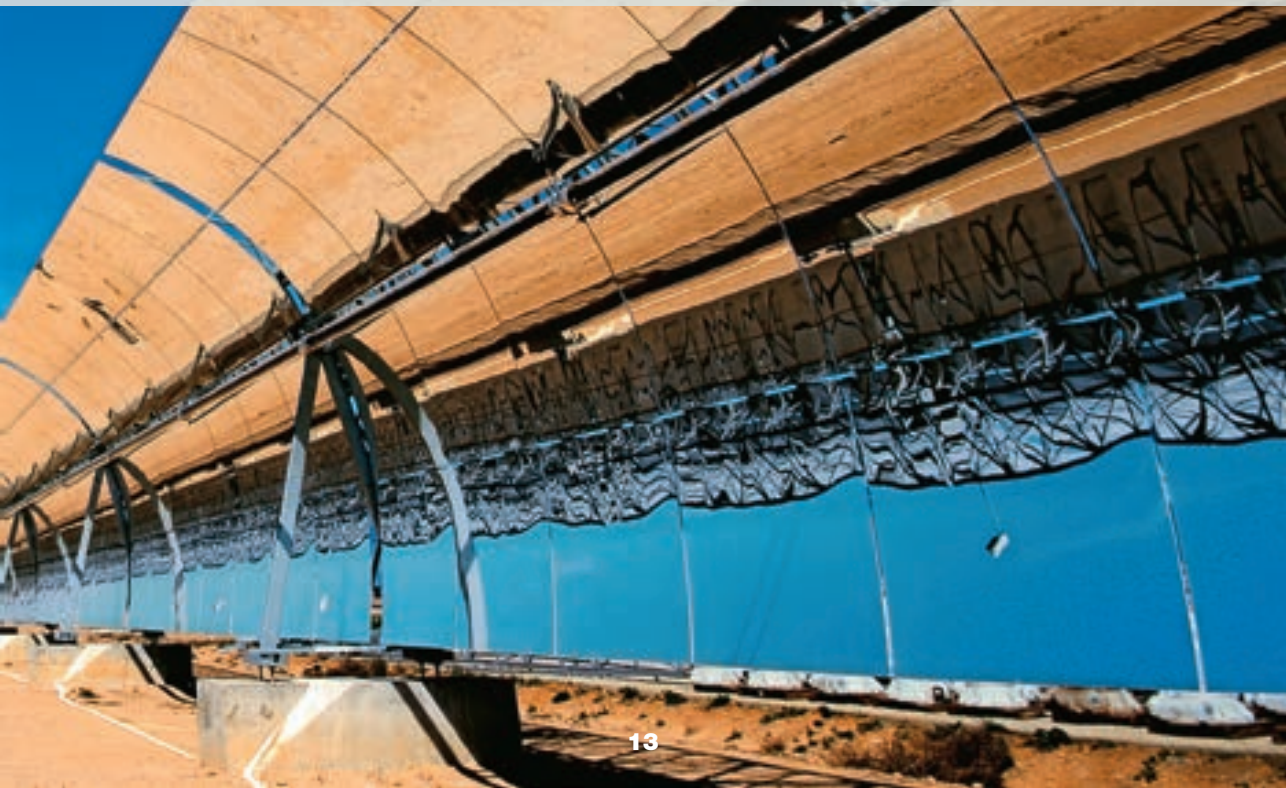




In March 2013, Masdar, Total and Abengoa Solar inaugurated one of the largest concentrated solar power plants in the world: Shams 1.

Extending over an area of 2.5 square kilometers, the plant is located in Madinat Zayed, approximately 120 kilometers southwest of Abu Dhabi in the United Arab Emirates (UAE). With its 258,000 parabolic trough mirrors, Shams 1 is expected to produce enough power for around 20,000 UAE households, with an output power of 100 MW.

With this ambitious project, we are expanding our solar energy activities by adding new technologies to our portfolio of expertise and supporting our long-standing partner, Abu Dhabi, as it pursues energy diversification.





DECENTRALIZED RURAL ELECTRIFICATION: BRINGING ELECTRICITY TO ISOLATED COMMUNITIES

TOTAL IS INVOLVED IN DECENTRALIZED RURAL ELECTRIFICATION, OPERATING THROUGH TWO RURAL ENERGY SERVICE COMPANIES (RESCO) IN SOUTH AFRICA AND MOROCCO.



IN SOUTH AFRICA

KUKHANA Energy Services (KES) was created in 2002 by EDF (50%), Total (35%) and Calulo (15%) to implement a decentralized rural electrification program based on solar energy in South Africa. By mid-2012, around 20,000 households, had been supplied with individual photovoltaic solar kits. KES is continuing its growth and plans to install another 30,000 individual solar systems over the next four years. LPG bottles from Total Gaz are distributed for back-up supply.



IN MOROCCO

Temasol, created in 2002 by Tenesol, EDF and Total, has equipped nearly 26,000 households, representing around 180,000 people. The company is now focusing on maintenance of installed photovoltaic systems, including replacement of defective and end-of-life components. Development avenues include photovoltaic installations for telecommunication relays, drinking water pumping stations and grid-connected solutions.



AWANGO BY TOTAL



TODAY, **MORE THAN 1.3 BILLION PEOPLE** WORLDWIDE DO NOT HAVE ACCESS TO ELECTRICITY.

THAT'S WHY TOTAL, THROUGH OUR ACCESS TO ENERGY PROGRAM, LAUNCHED A PROJECT IN 2011 TO ENCOURAGE THE USE OF PHOTOVOLTAIC SOLAR ENERGY IN THE COUNTRIES MOST AFFECTED.

In the developing world, lighting and cooking in particular often still require the use of energy solutions that are expensive, difficult to find and sometimes hazardous to health, such as paraffin and other lamp oils.

Awango by Total is a range of solar products for lighting and low-voltage electrical devices, mainly cell phones.

The solar lamps are priced affordably for low-income populations. For the target customers, who often live in off-grid areas, the products make a big difference in their lives, enabling them to carry on with their activities after nightfall. In addition, the solar lamps are more economical and less polluting than the kerosene lamps usually used in rural areas. They pay for themselves within a few months and cut annual carbon emissions per lamp by nearly 80 kilograms, while at the same time reducing accidents related to the use of oil lamps.



Following its launch in Cameroon, Kenya, Indonesia and the Republic of the Congo in 2011, the project was extended to Cambodia, Senegal, Burkina Faso and Haiti in 2012. **Awango by Total** was rolled out in several other countries in 2013. The aim is to provide access to lighting for five million people by selling one million lamps by 2015.

TOTAL SOLAR EXPERT



EDUCATIONAL SET

- CREATED IN PARTNERSHIP WITH TEACHERS
- TO RAISE AWARENESS ON ENVIRONMENTAL CHALLENGES
- AN EDUCATIONAL SET FREE OF CHARGE FOR THE SECONDARY SCHOOL
- AN EDUCATIONAL SET FREE OF CHARGE FOR HIGH SCHOOLS
- A SERIOUS GAME ON THE WEBSITE TO PROVIDE STUDENTS WITH A VIRTUAL EXPERIENCE RELATED TO THE FUTURE ENERGY MIX

ALMOST **80%** OF FRENCH
SECONDARY SCHOOLS ARE NOW USING ONE
OR MORE EDUCATIONAL SET,
POTENTIALLY **540,000** TRAINED PUPILS

WWW.KIT-PEDAGOGIQUE.TOTAL.COM

MASTER RENEWABLE ENERGY



**PRESTIGIOUS INTERNATIONAL
MASTER'S DEGREE** JOINTLY
INITIATED BY TOTAL AND
PARISTECH IN 2011, managed by
Ecole Polytechnique and supported by
EDF, PSA Peugeot-Citroën, Saint-Gobain
and Schneider Electric.

**MASTER 2 (MSC) DEGREE,
A ONE-YEAR POSTGRADUATE
DEGREE PROGRAM:** TO TRAIN
PROFESSIONALS WITH A GENUINE
TECHNICAL EXPERTISE IN THE
RENEWABLE ENERGIES FIELD



56 TRAINED STUDENTS SINCE 2011

See you at
www.total.com



New Energies
Total Marketing Services
Headquarters:
24 cours Michelet
92069 Paris La Défense cedex - France
Phone: +33 (0)1 41 35 40 00
Share capital: 318 822 302 euros
542 034 921 RCS Nanterre
www.total.com