The **solar school**

Alassane Agalassou is one of 26 technicians, engineers and project personnel designated by their governments or institutions to take part in this year's edition of UNESCO's annual summer school organized over a three-week period every July. This year's theme was Solar Electricity for Rural and Remote Areas. In tandem with a series of regional workshops, these annual 'schools' on solar electricity are helping to train skilled personnel, boost public awareness and promote relevant energy policies.

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Electrical cabling of solar panels and the installation of solar systems by participants as part of practical field-work organized by UNESCO in Bamako (Mali) in 2003

Over the past 15 years, over 500 trainees have 'graduated' from the summer school. They have gone on to become trainers themselves in more than 50 countries situated mainly in Africa but also in Europe and beyond, including Bolivia, Brazil, Canada, Colombia, Germany, Guatemala, Lebanon, Turkey and Vietnam.

Alassane Agalassou is employed by the Agency for the Development of Rural Electrification and Domestic Energy (AMADER) in Bamako (Mali) to give peri-urban and rural populations better access to modern electrical services, such as home lighting, refrigeration, television and radio. 'AMADER is facing the vital challenge of bringing modernity and hope to the majority of Malians through its decentralized electrification programme', Agalassou explains. 'You must understand that, in my country, only about 10% of the 11 million inhabitants live in communities with electricity'.

Agalassou intends to use his new knowledge of the economic and technological aspects of solar photovoltaic conversion to design and implement projects that will improve living conditions and health by making food production and conservation more efficient and more hygienic in a country where temperatures can soar into the forties.

The summer school targets men and women with technical or university training who are involved directly or indirectly in decentralized electrification using solar energy. The training programme covers both theoretical and applied aspects of solar energy conversion and is taught both by experts and by representatives of industry and specialized institutions.

Initially, the summer school included visits to research centres, industries and installations in France only. Since 1992, the financial and practical support of external partners has made it possible to venture as far afield as Belgium, Germany, Spain, Italy and Morocco for a series of technical visits which last a week on average. The remainder of the course is taught at UNESCO Headquarters in Paris.

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Participants learning to use sizing software to determine the exact energy needed for a given project, during a one-day practical session at this year's solar school

Practical training to assess solar radiation and simulate a solar installation. This session was organized at the CDER in Morocco during the 2001 summer school

What is solar energy?

Solar electricity is the result of the photo-electric (or photovoltaic) effect discovered in 1839 by the French physicist Edmond Becquerel. Photovoltaic cells convert the luminous energy of the sun into electricity. Most of the solar cells used are actually made of silicon.

Photovoltaic cells produce a voltage of approximately 0.6 volts (V) which is not dependent on the surface of the cell, unlike the electric current produced. To obtain a higher voltage, cells are linked up in a series to make a module which is the sum of the individual cells. The modules produce an unbroken current, the standard voltage for a commercialised module being 12 V. Depending on the installation needs, the modules can be connected in series to obtain a higher voltage. The most frequent voltages used in photovoltaic installations are 12 V, 24 V and 48 V. In general, the power produced by the modules is expressed in Watts (W), which corresponds to 10 W, 50 W, 75 W or 120 W for the commercialized ones.

In the early 1960s, solar conversion took off thanks to spatial applications. Since then, solar energy has expanded to include such applications as rural and decentralized electrification, water pumping and health and telecommunications; in other words, it goes everywhere the electricity network does not.

At isolated sites, the average cost of a complete solar installation (including batteries for storage) varies between 15 euros (excluding TVA) per Watt (for power of 1.5–2 kW) and 40 euros per Watt (for 200–400 W).

Solar-powered refrigerator used to conserve vaccines in health-care centres in rural and isolated areas. This technology was one of the subjects of this year's solar school

Modules *à la carte*

The course is structured by modules to enable specialists from different fields to choose the lecture of interest to them *à la carte*. Decision-makers, energy managers and others are thus able to choose whether they participate in a specific aspect of practical work, in a technical visit or in a given roundtable discussion.

Mahamat Oumara from Tchad is grateful to have refined his knowledge of photovoltaic technologies. But for him, the contacts he has made through the summer school are equally valauble. His only regret is that, 'if we had better equipment in our own laboratories to test essential materials, we could do a better job of spreading the technology.'

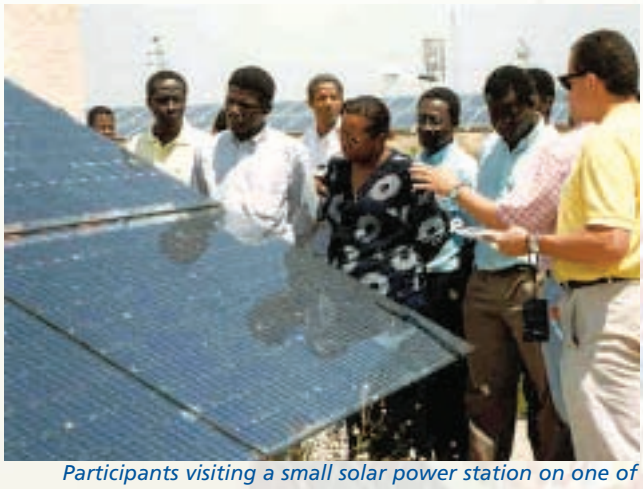
'One of the greatest obtacles to developing renewable energies in our countries', Oumara adds, 'is the dearth of relevant information at all levels. This affects not only decision-makers and users but also those engineers and technicians who lack the necessary know-how. The local rural population would benefit from well-trained project managers', he notes. 'Good project management extends a system's lifespan and leads to cost-savings, not to mention better use and maintenance of the systems once these are installed. Similarly, a good engineer will design a better project and thereby increase the chances of attracting funding. He or she will also tailor the system better to the needs of the end-user, which can translate into cost-savings for the rural population'.

Demystifying solar energy

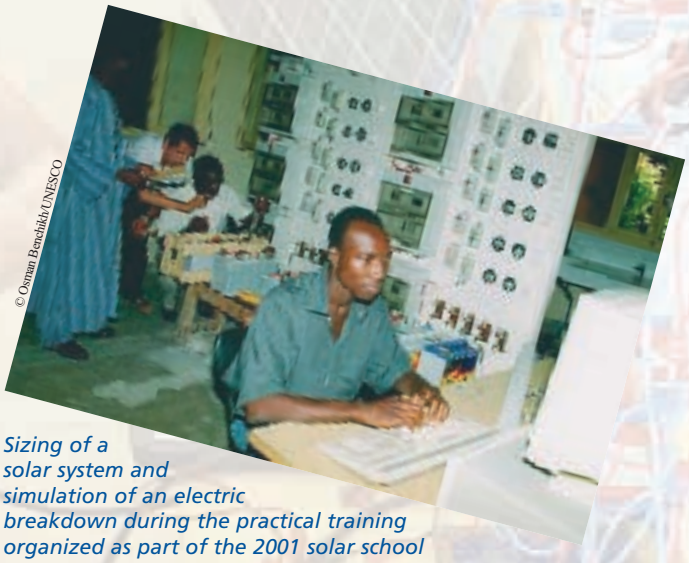
Along with three other French industrialists, René Desserrières of French Solar Manufacturers Photowatt has lectured at the school for the past three years. 'We always know about 20% of students,' he says 'which can make for animated discussions about existing installations and component parts between manufacturers and users, who really get down to the nitty-gritty.'

Desserrières explains that the summer school is an excellent complement to other training activities which are more closely linked to specific projects. 'The UNESCO course is given in another spirit,' he says. 'It aims at a higher level of engineer and technician. Despatched by their countries or a local or regional institution, these young people will eventually play an important role in designing and implementing rational energy policies, hopefully avoiding the errors of the past when it comes to planning and project management in particular. The summer school promotes a realistic approach which debunks the myths and demystifies solar energy'. He observes that, 'Both sides need to treat one another like partners. Some experts in developing countries regard us as nothing more than the suppliers of a technology they would like to see transferred without delay.'

Using a platform to simulate a solar system in 2002. This training platform was developed by UNESCO in collaboration with the French agency, ADEME



Participants visiting a small solar power station on one of several technical visits organized in Spain during the 2001 summer school on the same theme of 'solar electricity for rural and remote areas'



Sizing of a solar system and simulation of an electric breakdown during the practical training organized as part of the 2001 solar school

For Desserrières, the manufacture of photovoltaic cells remains too sophisticated and costly to transfer. 'Nevertheless,' he relativises, 'developing countries can produce other components and, by developing solar electricity, reap 80% of the benefits, create jobs and improve the standard of living in their rural communities.'

Many regional institutions send engineers and technicians to UNESCO's summer school. These include the Centre for the Development of Renewable Energies (CDER) in Algiers (Algeria) and the National Centre for Scientific and Technical Research (CNRST) in Rabat (Morocco). 'For our higher level people,' says Abdelaziz Bennouna, head of the renewable energy laboratory at CNRST, 'the course is excellent from many points of view; it keeps us abreast of what is going on in the field, we meet key people, form contacts with top-level faculty members and, last but not least, meet specialists from other regions'.

People are in the market for energy

Almost two billion people in rural Africa and elsewhere still lack access to basic electrical services. 'It is very sad to see, in this new millennium, most of the rural population in the developing world still using candles and petrol lamps', laments Bennouna. He regrets the lack of technological autonomy in even those countries which use and apply renewable energies on a massive scale. For Bennouna, 'solar cells and silicon are unfortunately not going to be produced and manufactured in the foreseeable future. The industrial process for solar cell production calls for high technological know-how and sophisticated technology that needs a large market to be profitable and economically viable. '

'This said', he adds, 'enormous progress has been made. In some countries today, solar system components are being locally manufactured, commercialized and even exported. In Morocco for instance, solar systems are sold in the market-place by local merchants along with fruit, spices and other goods. Mentalities have changed. People are now in the market for energy; they are purchasing their own 'solar kits' in much the same way they would buy a television set or refrigerator. This is one way in which solar technology is trickling down to the end-user and becoming a household name'.

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