

Auroville:

Could it be the solar future for India?



Workers setting up a solar streetlight

Photos (7): Axel Grabitz

The sun is sacred in India – and almost always to be seen. The conditions for the use of solar energy are ideal in a country whose southern regions boast some 3,000 hours of sunshine a year. In the international township Auroville in the South of India, photovoltaic installations are omnipresent already today.

There is one period every year during which Carsten Michelsen definitely has his hands full. In early summer, the orders pile up on his desk, and practically all are marked as “urgent”. Early summer is school examination time, and families need electric lighting in the evening hours, after their work in the fields, for the children to be able to learn. Carsten Michelsen, who emigrated to India from Germany in 1993, then does his best to support the Indian children with their schoolwork, and supplies solar lighting systems to families all over the country. His compact lighting systems cost between US\$ 100 and 400. That is a lot of money for an Indian family, but still less than the cost of connection to the Indian grid. And according to the estimates of the German

Agency for Technical Cooperation (GTZ), almost 50% of the households in rural India possess no such grid connection.

In the gardens of "Auroville Energy Products", women are watering the banana plants. The building with the spiral steps in the yard, like all the houses here, has fly screens rather than glass windows. It is winter, but the temperatures drop only to around 25 °C, and the fans continue to buzz as always in Carsten Michelsen's office. The sun, he says, is the only resource which is to be found in abundance here. In the summer, it drives the temperatures to a scorching 45 °C. And it is one of the reasons why the solar branch is growing strongly in India. With 250 to 300 days of sunshine every year, the irradiation energy amounts to between 4 and 7 kWh/m²d, depending on the individual location, which over the whole territory of India represents a multiple of even global energy consumption. Another reason for the upswing in solar energy is "a lack of trust in dependent relationships, including dependency on electricity companies", says Carsten Michelsen. "More and more Indians want small, off-grid solutions for their homes." Not least because hour-long blackouts are the order of the day here.

Building a utopia: Auroville

Carsten Michelsen came to Auroville for the first time in the mid-1980s, as an electrical engineering student. Visionaries from around the world had selected this community in the Southern Indian state of Tamil Nadu as the place for realisation of their social utopia. Auroville was founded in 1968 and as an "international township" enjoys a special status within the Indian state: here, many things are possible which would be difficult elsewhere due to legal or bureaucratic hurdles and social conventions. On land which does not belong to private persons but to the Auroville Foundation, the founders set up ecologically sustainable farms, reform schools and a common economy without cash. The long-term electricity demand was to be covered wholly by renewable energy sources. At that time, there was general consensus in Germany that renewable energies were not suited to serve as a reliable pillar of power supplies. Michelsen was not prepared to just accept that opinion. "It is technology, and technology just has to be developed further", he thought.

The conditions for the development of renewable energies were exceptionally good in Auroville. There was financial aid, a large pool of volunteers and a population which was very much interested in ecological progress. A newly founded institute, the "Centre for Scientific Research" (CSR), engaged in the development of energy systems based on sun, wind and biomass, as well as building and water treatment technologies. The CSR developments were not only intended for Auroville but to be distributed throughout India through the Aurore Trust founded in 1998. The trust today provides marketing and support for developments from CSR across the whole subcontinent.

A sun at the centre of the town

In the nineties, the CSR developed and installed 200 solar home systems and 140 solar water pumps in Auroville. Solar streetlights were set up along all the public streets, and the central kitchen, which serves 1,000 meals twice a day, is called the "Solar Kitchen", after the 15-metre solar collector



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Water evaporator on the roof of the solar kitchen in Auroville



This collector produces steam for cooking in the solar kitchen. The receiver tracks the focal point of the sun.

City of visionaries

In 2008 the town of Auroville, 130 km south of Chennai in the Southern Indian state of Tamil Nadu, celebrated its 40th anniversary. Auroville sees itself as an "international place which belongs to nobody in particular, but instead to humanity as a whole". The idea was born by Sri Aurobindo and his companion Mira Alfassa, who initiated the project. Buildings and an infrastructure for 50,000 people were planned over an area of 25 km². Approximately one-third of the individual projects have been realised to date, but the town so far counts only around 2,000 permanent residents. The long-term vision pursued by the Aurovillians builds upon ecological agriculture and afforestation, reform education, a cashless economic system, emission-free transport and energy supplies based solely on sun, wind and biomass.



on the roof which produces the steam required for cooking. A 36.3 kW PV generator supplies electricity to the "soul of the city", the Matrimandir. Guests from all over the world come here to meditate under the 34-metre gold-tiled sphere, which was designed as an architectural "oasis of strength and peacefulness". The building looks a bit like a fireball breaking out of the earth's interior – and when the sun shines upon it, the observer could believe it to be a reflection of that sun.

The three buildings of the CSR can be reached from the Matrimandir by bicycle in just five minutes. In the courtyard, the institute's peacocks pick at rice grains, while on the upper floors Indian and European engineers work together on the development of new applications for solar technology. The mechanical team on the ground floor experiments to find the best implementations of their ideas, and the products of their work can be seen in the garage next door, for example the prototype of the electric taxi which provides free transport between the Matrimandir, the visitor centre and the other buildings for the visitors to Auroville. Was all that planned as a model for India? Not really, says Hemant Lamba, the Indian head of the CSR: "It just turned out that we were among the first to develop and use solar energy in India. We research technologies for Auroville, but if they work, then we do indeed offer them to a wider public."

One of the developments which the centre is testing at the moment is a solar cooler for ecological air-conditioning. The unit in the CSR hall is still only a prototype. Like most of the products developed by the institute, it operates on a simple but reliable principle. Solar collectors are used to dry calcium carbonate salt in an accumulator. If moisture is then introduced into the accumulator, the salt absorbs it and reacts with a strong cooling effect.

The cooling of rooms is a high priority in India, especially in the summer. With an annual economic growth of 10 %, the incomes of the middle and upper class are also increasing, and their first major purchase is often an air-conditioning system. The desire for cooling is causing electricity consumption to rocket in India, which is after all the second most populous country in the world after China. There is thus a good chance that the solar cooler will be in great demand nationwide as an ecological, grid-independent alternative to conventional cooling systems once the development becomes ready for serial production.

Solar pumps for rural India

Whereas air-conditioning is only likely to benefit Indians with higher incomes, even in the medium term, the solar pumps developed in Auroville are serving many poorer families in rural areas already today. Women carrying water jugs on their heads are still a common sight here. But in the village Ruipathar

in the Maharashtra region, they will no longer have to carry water in the future: CSR technicians have installed a solar-driven pump, financed by the Indian NGO (non-governmental organisation) Maitri, to pump the water 50 metres from the well in the valley into the centre of the village.

The SQFlex pumps developed in Denmark are operated on a 900 W solar generator, and can deliver 20 m³ of water a day over a distance of 30 metres, or 6 m³ over a distance of 120 metres. Thanks to the solar panels, the pumps can also be used in the many villages which have no connection to the electricity grid. The CSR has installed 400 systems all over India since 1993.

If there is no NGO to take care of the financing as they did in Ruipathar, the purchase costs of 42,000 rupees (€ 660) for a 50 W panel lie way beyond the means of most farmers. That demand nevertheless continues to increase is in part thanks to the Aurore Trust, which offers to extend the time for payments for farmers living in the surroundings of Auroville. In addition, it is possible to obtain direct government



One of numerous wind turbines in the centre of Auroville. The model AV55 was manufactured by the local company Aureka.

Renewable energy systems in Auroville

- 30 wind turbines on the territory of Auroville, each 25 m high and with a rotor diameter of 5.5 m, mostly of type AV55, used predominantly to drive water pumps. The wind turbines were manufactured by the local company "Aureka".*
- Biogas systems producing between 2 and 4 m³ of biogas daily.*
- A "solar kitchen" with a 15-metre solar collector integrated into its roof. The collector is cast in concrete and lined with thousands of mirror elements. A special mechanical facility enables a receiver to automatically track the wandering focal point of the sun. The system supplies steam at a temperature of 150 °C, with which the kitchen prepares up to 1,000 meals twice a day.*
- A 36.3 kW PV installation which has been supplying electricity to the centrally located Matrimandir and the surrounding gardens since 1997. According to CSR, the generator and its 484 monocrystalline modules were at that time the largest off-grid system in India.*
- 140 PV-driven water pumps with an output of approx. 1 kW each.
- Solar thermal systems from Apricus for water heating. The systems have a capacity of between 100 and 300 litres and are sold all over India.
- 80 streetlights which are charged by way of 20 or 37 W solar panels during the daytime.
- "Namuna" – a small, two-seater hybrid car, which is used as a taxi. It is intended to build more of the cars at a price of 250,000 rupees (€ 3,900) for the Aurovillians.

* Subsidised by the Ministry of New and Renewable Energy (MNRE)



Prototype of the solar taxi "Namuna", which transports visitors in Auroville

grants of up to 50 % for solar pumps, alongside low-interest loans. The distributing company, furthermore, is able to offer a discount, and is in return entitled to a 100 % tax write-off.

Electronics made in Germany

Carsten Michelsen similarly asked himself why solar technology remained unaffordable for many Indians, despite the rising incomes of the middle class. One reason can be seen in the fact that the solar modules and electronic components are all manufactured in the high-wage country Germany. The production and repair costs could be reduced, he concluded, if local manufacturing were to overcome the reliance on imported products. Michelsen left his earlier job at the CSR and in 1996 founded "Auroville Energy Products"

(AEP) with plans to manufacture solar components. Since then, he has been importing cells from German module manufacturer Phocos and building them into panels locally. It is not easy to establish a company in India: "Nothing can be taken for granted. You have to push the whole time, for example to ensure that the components required for production are delivered on time." Even so, his idea was a success, and the original workforce of two employees grew to twenty in just four years. In the meantime, the company sells also solar home systems and controllers – first concentrating on Auroville, later in the whole region and today throughout India. AEP was one of the first solar companies on the market, and is also one of the largest with a market share of 20% in its segment and an annual production of 20,000 solar system controllers.

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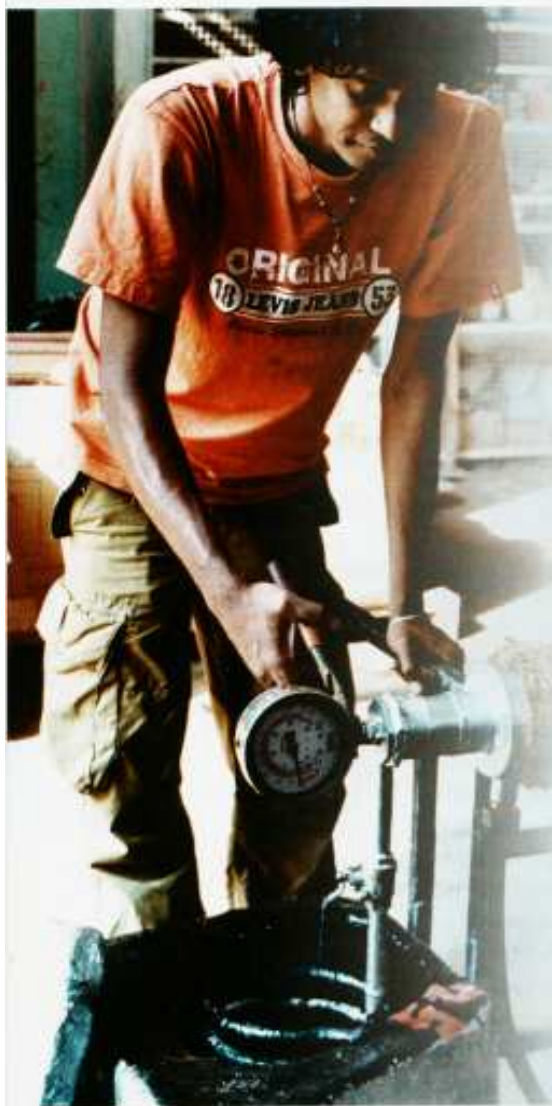


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Solar energy on the up in India

Indian journalist Avilash Roul has calculated that the demand for solar cells in India has risen by an annual 25 to 30 % over the past 15 years – and there is still no end to this growth. This is partly due to the fact that the production costs for solar cells have dropped to only 10 % of their level in the early 1980s. India is the seventh largest producer of PV cells in the world, and occupies ninth place for solar thermal systems. According to the Ministry of New and Renewable Energy, 2 million m² of solar thermal collectors and 1.4 million PV systems have been installed to date. Viewed overall, however, photovoltaic generation accounts for only 0.02 % of the energy in India's electricity grids; the total share of renewable energies is 2 %. On the other hand, this figure does not include the off-grid systems which are extremely widespread in India, but whose capacity is difficult to estimate. A government programme aims to increase the share of grid-integrated photovoltaics to 50 MW by 2012.

Rajesh from the CSR with the solar cooler Photos (2): Friederike Rühl

Radiating over the continent

When you drive through Auroville as a visitor today, it seems not to be a town, but rather a widely spread village among thousands of newly planted trees. And a major building site: wherever you look, new projects are being planned and realised, supported by hundreds of volunteers who spend their holiday here. Without them, says Hemant Lamba, some of the projects would no longer be economically feasible. After all, instead of the originally envisaged 50,000, there are only around 2,000 permanent residents in Auroville today – the largest national groups being the French, Germans and Indians. There is still plenty of work awaiting the Aurovillians: according to Lamba's estimates, only 30 to 40 % of the households, in other words around 300 families, are using solar systems. One particular thorn in Carsten Michelsen's flesh is the fact that the most popular means of transport is still the motorcycle – he dreams of a noise- and emission-free town and is working on the development of an electric bicycle with solar charging stations everywhere in Auroville.

Such dreams, together with the projects which he and his colleagues from CSR have already realised in Auroville, are inspiring people elsewhere in the country to follow his example. Hemant Lamba does a lot of travelling to promote cooperation and to market the

research results of his institute in the rest of India and abroad in Asia. And his work is also made appreciably easier by the many renowned awards he has received for his developments and the fact that the CSR has been named as one of the three most important training centres for environment protection in the world by the WHO.

AEP is also expanding. At the beginning of the year, a large share of the manufacturing was transferred to Chennai, the next big city in the South of India, as production can be larger and faster there and the city offers a greater pool of trained workers and closer contacts to suppliers. The manufacturing facility in Auroville has become too small, but Carsten Michelsen will be staying here, in the town which "drew him in like a vacuum" in 1993, and will concentrate on the development of new technologies in the future. He only sells solar lamps when the schoolchildren have their examinations, and today devotes his attention instead to the initiative "Mission Tejas" which was founded by Aurore to promote clean light sources to replace the dangerous and smoky kerosene lamps which 86 million Indians still use for lighting.

The solar pioneers have a long road ahead of them, because Auroville is not India. Elsewhere, there is less awareness of the importance of renewable resources for future energy supplies. Kavita Kumar, the financial administrator of CSR, described the situation as follows: Even if people have the financial means, that still doesn't mean at all that they are going to invest in solar energy. In this respect, India is no different from Europe. But perhaps the technology transfer radiating from Auroville will gradually be joined by a corresponding transfer of awareness to the rest of the country.

Friederike Rühl

Further information:

Auroville: www.auroville.org

CSR/Aurore: www.aurore.in

Solar lamps: www.missiontejas.org

Wind-driven pumps and building technologies: www.aureka.com

Ministry of New and Renewable Energy: www.mnre.nic.in



Hemant Lamba, Director of the Centre for Scientific Research