Towards a Sustainable Future
Auroville's Habitat & Renewable Energy Experiments, 1977-2001

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"This erring race of human beings dreams always of perfecting their environment by the machinery of government and society; but it is only by the perfection of the soul within that the outer environment can be perfected."

Sri Aurobindo

On the coast between Chennai, the capital of Tamil Nadu, and the former French town of Pondicherry, lies Auroville - an international township experiment which was inaugurated on 28th February 1968. Over the years support for the project has come from the Government of India, UNESCO and a host of other international organisations and foundations.

Now, thirty-two years later, the project is growing towards a sustainable future.

It is debatable whether a community consisting of 1700 inhabitants, comprising 37 nationalities can be held as a global model for solving the problems of the world. But then, Auroville keeps confounding conventional wisdom.

Auroville's uniqueness lies not only in its dedication to establish 'a living human unity', but also in its "mission statement", a charter composed of four themes, which forms the basis of its overall progress and development.

Auroville Charter – 28 February 1968

1. Auroville belongs to nobody in particular, Auroville belongs to humanity as a whole. But to live in Auroville one must be the willing servitor of the Divine Consciousness.

2. Auroville will be the place of an unending education, of constant progress, and a youth that never ages.

3. Auroville wants to be the bridge between the past and the future. Taking advantage of all discoveries from without and from within, Auroville will boldly spring towards future realizations.

4. Auroville will be a site of material and spiritual researches for a living embodiment of an actual human unity.

Over three decades, countless trials and experiments have taken place with the aim of integrating appropriate technology into the design of buildings and communities. This endeavor is exemplified in three buildings.

In the mid seventies a residential building was constructed called **'Eco-house'**. It was one of the very first attempts in India to build a climatically appropriate house which integrated solar cooking and water heating with rooftop rainfall harvesting and a multifeed biogas plant. A roof mounted wind generator was also contemplated but not installed.

The experiment was too far ahead of its time to succeed, as the technologies had not matured then. However, it provided the first data on costs and technology integration. One clear conclusion was that for ecological and economic sustainability, group housing rather than single housing is necessary. [1]

ECO-HOUSE	***TECHNOLOGIES***
1975 – 1977	Rainwater harvesting with underground cistern
	Roof integrated solar water heater
***AREA* :**	Window mounted retractable solar cooker
140 m^2	Multifeed biogas plant, usable as septic tank, if required
***TOTAL COST* :**	Three different types of experimental roofs (Hollow concrete tiles, Prefab brick jack arches, Madras terrace roof)
U$ 1400	Design for Ventura ventilation via inner courtyard

The second experiment was a public building. **'The Auroville Visitors Centre'** was designed and built in 1989. The building comprises exhibition and conference space, with a boutique and cafeteria situated at one of the major entrance roads to Auroville and serves as an entry point for the numerous daily visitors.

The building demonstrated the use of 'sustainable technologies', including low energy building materials and on site waste water recycling.
Several cost-effective and alternative technologies had matured by mid eighties. Attempts to integrate everything in a functional and pleasing environment was quite successful and won the first Hassan Fathy International award in 1992.

The most significant learning experience came from the manufacturing and use of 160,000 stabilized earth blocks. They were made on site with local soil mixed with 5% cement and compressed in a manual press. Cost-effectiveness was achieved by having these unfired compressed mud blocks used in combination with locally prefabricated ferrocement roof channels, sunshades, doors and water tanks. All these building technologies, machines and design procedures had been evolved in-house. An Auroville researched and manufactured wind pump was installed for pumping water, and has been functioning very satisfactorily for the last ten years.

The unreliability of the rural electricity grid, and the existence of an electronic unit which made charge controllers and procured CFL lamps, made us decide to employ solar PV systems for electricity generation. However, there were problems with the use of "end of shelf life" submarine batteries, each cell of 2V and 20.000 Amph for a 24V-output supply. The solar PV array proved insufficient to maintain the submarine batteries because of their high self-discharge rate and a diesel back up was necessitated to keep the system operational. The limit of solar PV systems was thus experienced.

Further hybridization was tried with the installation of 2 prototype wind generators of 4kW peak capacity each. The average wind speed of 3 m/s at a height of seven meters was sufficient for the multiblade wind pump, but insufficient to keep the rotors of the wind power generators turning regularly.

A waste water treatment plant for the recycling of the guest bathroom facilities has also been added. It is a vertical planted filter design, constructed on the site were the soil for the compressed earth bricks had been extracted.

The building proved a useful testing and learning process for applied technologies. It also proved a catalyst for further applications of appropriate building technologies within the community and outside. The difficulties in integration renewable energy devices demonstrated that experience had to be gained in this area. [2]

VISITORS CENTRE	***TECHNOLOGIES***
1989 – 1991	Compressed earth blocks
	Ferrocement roof channels and building elements
AREA **:**	Solar chimneys
1200 m^2	Wind pump
TOTAL COST **:**	Water solar PV pump
U$ 9400	Wind generators
	Decentralized waste water system (Dewats)

The third and most recent integration attempt is demonstrated in the **'Solar Kitchen',** a community kitchen for preparing 2000 meals a day. The concept began to be implemented in 1994.
Since solar energy is abundant in southern India, using steam as the heat transfer medium for preparing the meals was the obvious choice.

The innovative decision to integrate in the building a fixed spherical solar bowl concentrator of 15 meter diameter determined, to a large extent, the design and technology applications used within the building itself.

Renewable energy features

The solar bowl is positioned at the western end of the first floor. Composite granite blocks were used for the foundations. Walls in compressed earth blocks support the whole structure. A total of 96 prefabricated ferrocement elements were cast and hoisted in place to form a perfect fixed spherical bowl. Research led to the optimum size (15x15 cm) for the 11.000 hand cut flat facets with ordinary 3mm mirror glass. Each single mirror piece had to be hand placed with an accuracy of 5 to 10 arc minutes, achieved with a simple laser pointer placed at the centre of the sphere.

A tilted fixed mast supports a moving receiver which can rotate in all directions around a double-axis articulation placed at the centre of the sphere and balanced by a counterweight. A computer programme ensures the automatic tracking of the whole system with scope for seasonal changes.

The solar bowl had also to be hybridized with a conventional diesel fired boiler back-up system for cooking on an off-on basis. The interface is through a heat storage tank using thermic fluid storage (1.4 m^3) with one-hour heat storage capacity.

Possible future replicability for community cooking, power generation, desalinization and cold storage have been kept in mind.

Climatically appropriate design features

With the necessary reforestation on the Auroville plateau already established, a comfortable micro-climate is taking shape. Further improvements of comfort levels in a warm humid zone are achieved by integrating solar passive systems in buildings.

The long façade of the building was oriented north - south at a 45 degree angle to the prevailing wind direction. This helped to increase indoor air velocity while giving a minimal sun load.

Adequate roof insulation, through the use of broken bricks mixed with lime and sand on top of the 10 meter free span ferrocement roof channels, is the most cost effective way to save energy. Within the building air circulation is increased through ventilation chimneys, which serve also as deep light wells. A small water body on the east side of the building, in the direct path of the wind direction, is provided for. [(3)]

SOLAR KITCHEN	***TECHNOLOGIES***
1994 – 1997	Compressed earth blocks
	10 meter long ferrocement roof channels
AREA **:** 2000 m^2	Decentralized waste water system (Dewats) consisting of Imhoff tank, baffled reactor and polishing pond
TOTAL COST **:** U$ 302.500	Solar bowl concentrator of 15 meter diameter
	Scheffler community cooker concentrator

The on-going learning curve of the Auroville experience, "taking advantage from all discoveries from without and from within", is propelled by multidisciplinary research projects which involve cooperation and creativity between Auroville residents and the scientific community at large.

A continuing commitment towards perfection in all spheres is the hidden key to the dynamism of the Auroville experiment.

References

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