

*"You can never change things by fighting the existing reality. To change something build a new model that makes the existing model obsolete."*

Buckminster Fuller (1895-1983)

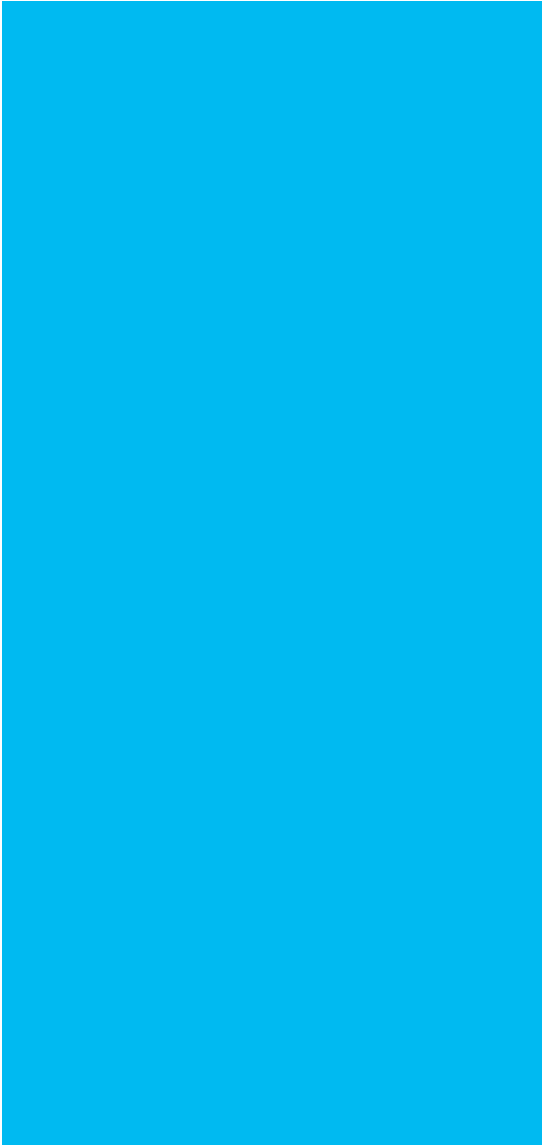
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# THE ENERGY AUTONOMY PLAN FOR TAMERA

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STRATEGY FOR 2017-2020





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## WHAT IS TAMERA?

Tamera is an international training and research centre in southern Portugal, researching and developing working models to provide solutions for the urgent global issues of water, food, energy and human co-existence without violence for the 21st century.

Here in Tamera, experimental solutions are studied and developed with the aim of making a post-fossil fuel future possible. We acknowledge that sustainability needs a foundation in a new societal structure, so our efforts to create a model for 100% autonomy in energy supply are intimately connected with building community with truth and trust at its core.

Clean and decentralised energy autonomy is a critical issue in the emerging anthropocene epoch. The extraction of non-renewable resources leads to wars and the ever increasing destruction of ecosystems and societies. A peaceful world of the future will need decentralized regional energy systems that can capture and transform clean locally available energy, for human use. Cooperation instead of exploitation will be key.

Presently 52 % of Tamera's electrical needs are met by photovoltaic installations. Its warm water solar collectors provide much of the domestic warm water needs and straw-bale construction showcases energy efficient architecture. Our aim is to show that a 100% regenerative energy supply can provide local communitarian solutions to global problems.





*Tamera at sunrise*

*“Our aim is to show that a 100% regenerative energy supply can provide local communitarian solutions to global problems.”*



*Qualification Measurements on the Ultralight Membrane Mirror*

*“Our vision is clear: A fully autonomous, regenerative and decentralized energy system; one which can also be assembled and maintained on-site.”*



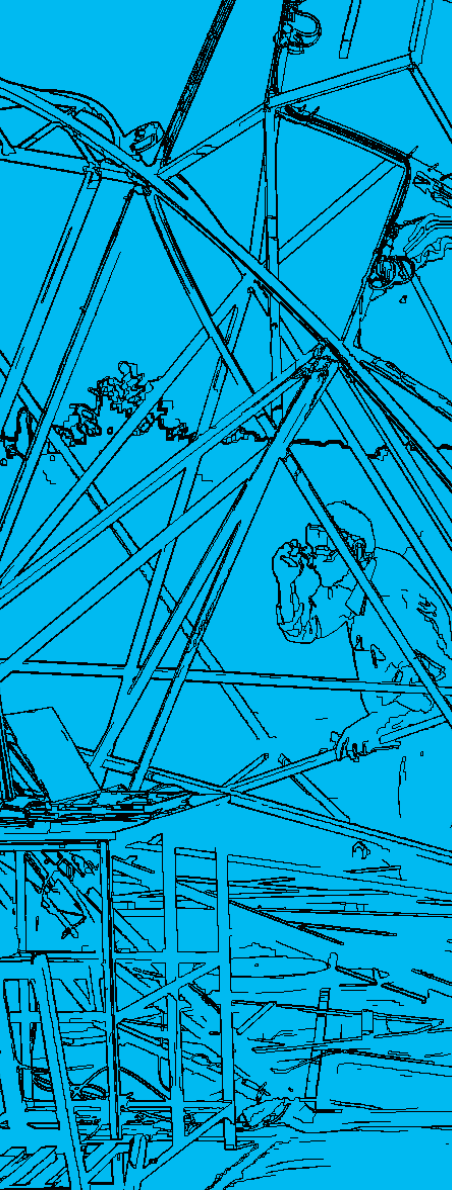
## OUR ENERGY AUTONOMY VISION

Our vision is clear: 100% energy autonomy for Tamera. We aim to become a working example of a fully autonomous, regenerative and decentralized energy system; one which can also be assembled and maintained on-site.

Our goal is to develop a modular approach which combines many available technologies in order to provide energy autonomy for a typical settlement, including low-infrastructure situations in the Global South or refugee camps.

The components of this modular system include: solar architecture with and without photovoltaic panels; cooking with biogas, direct sunlight and solar-heated hot oil; solar cooling, solar temperature regulation for buildings – with and without seasonal heat storage; solar electric transport; a combined heat and power system run on wood gas and biogas; and various regenerative energy technologies for huts and temporary structures.

These energy systems can be installed to provide immediate help in crisis areas and refugee camps and can also be instrumental in the development of long-term sustainable settlements. Our own installations will also be used for education. Knowledge transfer begins with us; living within the systems and sharing the experience with people who wish to learn, in this way, others can build and optimise systems that can be integrated into their own daily lives.



### **Solar Architecture Combined with Electrical Generation. Photovoltaic Panels and Battery Storage.**

Our projected electrical energy needs will be fully covered by roof mounted photovoltaic panels. Our plans include one photovoltaic membrane shade-roof, providing a synergy of both shade and energy production in an aesthetically attractive structure. The electrical energy generated will be stored in a battery bank for use during the night. We are investigating alternatives to common battery systems, which can often be toxic and harmful to the environment.


### **Solar Cooking: Hot Oil Kitchens, Biogas and Solar Concentrators**

We are planning to convert two community kitchens in Tamera to 100% solar energy using hot oil, biogas and solar concentrators. Concentrating vacuum tube solar collectors will heat vegetable oil, in a closed circuit, to a temperature of approximately 200°C. The hot oil is stored in an insulated tank for night time use and cooking is done by pumping the hot oil through double-walled pots and frying pans. Biogas replaces bottled or grid gas, and Scheffler mirrors concentrate direct solar energy for immediate use. The combination of these elements allows 24 hour kitchen operation.

### **Wood Gas and Biogas Combined Heat and Power (CHP) System**

We have an abundance of shrubs and bushy plants in Portugal, which are often dried out by the arid weather, especially in summer. These can be annually harvested, then chipped or shredded, and converted to wood gas through a gasification process. This gas, or indeed biogas, can power a generator and be converted into heat and electrical power, complementing





the solar electricity system, providing a constant electrical energy supply.

### **Solar Temperature Regulation for Buildings, with and without Seasonal Heat Storage**

A system of solar thermal collectors mounted on the roofs and connected to a 500 litre hot water storage tank can heat the walls of buildings. When needed, a secondary heat source such as a wood stove can provide extra heat in the winter months.

For larger structures, an underground seasonal thermal storage tank of 20-100m<sup>3</sup> will be installed within the foundations of the buildings to store the heat of the summer to be used in winter. This form of temperature regulation also works to control damp in the building structure.

### **Solar Electric Transport**

Viable alternatives to fossil-fuel combustion engines are part of the model for an energy-autonomous life. We plan to introduce electric vehicles for the transport of both goods and people, including bicycles, e-bikes, e-scooters and e-cars.

### **Solar Cooling**

Using solar energy for cooling is particularly attractive as the need for cooling is highest when the sun is the strongest. We plan to introduce the following solar cooling prototypes: solar absorption coolers, reversible Stirling engines and photovoltaic produced electricity powering conventional refrigeration.



*Tamera's Energy Autonomy Team celebrating with solar-cooked pizza.*

*“ Sunlight is the finest and most beautiful energy source. We humans are slowly coming closer to understanding how to work with such high energy, and seeing which technical, artistic and spiritual possibilities arise.”*

Dr Douglas Baillie, physicist and member of the Solar Testfield.



### **Solar energy for Huts, Temporary Structures and Campsites**

In many lower income countries as well as refugee camps, the normal building and living conditions include huts, temporary containers and caravans. We want to demonstrate sustainable ways of heating these smaller living structures.

Tamera has many caravans and small huts available for test installations. We plan to trial four different heating systems to eliminate the need for bottled gas: a) A photovoltaic system with a small battery bank; b) A solar thermal heating system; c) Replacing bottled gas with biogas and d) Using aerobic biomass composting for heat generation.

### **Solar Energy Generation with a Stirling Engine and Thermal Storage**

An innovative low-temperature Stirling engine will be installed in Tamera's Solar Testfield. As prime mover in an energy supply system providing electricity, cooling, mechanical and heating energy, the selected Stirling engine - SunOrbit's Sunpulse - can deliver 1500W continuous electrical energy. The engine is a result of decades of research by Jürgen Kleinwächter and his team to develop simple and efficient Stirling engines which operate in the temperature range delivered by low-concentration solar collectors. This system can also be used for cooling by reversing the energy flow by driving the engine with an electrical motor.

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## THE SOLAR TESTFIELD

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The Solar Testfield is a sub-entity within Tamera which concentrates on testing and showcasing research developments. It is one of the locations where the elements mentioned above will be combined with existing installations and tested by a group of people by integrating them into their daily life.

The heart of the Solar Test Field is the kitchen which feeds up to 60 people using solar technologies: a Scheffler mirror, biogas, solar box-cookers, solar water heaters and a solar tunnel-dryer for food preservation. The kitchen forms part of an autonomous holistic approach in which humans are integrated into healthy food, water and energy cycles. The Testfield has long-term experience researching and developing diverse integrated energy supply systems in cooperation with Jürgen Kleinwächter. The Testfield is becoming a living demonstration that cooperation with nature is not only possible but also brings a high quality of life.

One inspiration for the Testfield is Lynne Twist's story of the request by Indigenous Ecuadorian tribes for allies from the North to "change the dream of the modern world" by shifting its culture of over-consumption to a culture that honours and sustains life.

The Testfield workshop is the location for development work, most recently around an ultralight membrane mirror for high solar concentration, and experiments with Sunpulse engines driven electrically as cooling systems.

Education in such a surrounding enables people from all over the world to come and visit, experience and learn. They can then adopt and adapt this knowledge to their needs.

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## FINAL NOTE: VISIONS FOR THE FUTURE

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We envision a life that is full of joy and curiosity. One where we try to understand the world we are living in and, by cultivating compassion and sharing knowledge, help to end conflict.

Some ideas that excite us – not yet plans, not concrete, not complete...

[In and around the workshop](#) an emerging free-lab space where people with innovative spirits and a heart for the world come together, share and further develop knowledge, carry out tests, publish results.

[Taking developments](#) such as the low-temperature Stirling water pump to a point where it can be manufactured in simple workshops, finding partners here in Portugal to build it, and taking the knowledge to the world.

[A group of people](#) inspired by the Biosphere 2 project in Arizona, who create a well-prepared and documented follow-up experiment for life in community, in cooperation with their environment.

[The Cradle to Cradle](#) concept developed by William McDonough and Michael Braungart increasingly inspires us to steer our efforts to apply their basic guidelines.

[The Energy Autonomy Project](#) needs ongoing infrastructure maintenance. An important part of the project will be building a team of professionals who take on responsibility in community. Applications are welcome.

## WHAT FUNDING IS REQUIRED?

To make Tamera 100% energy autonomous, and to introduce the comprehensive modular approach described above, we need financial support. As you can imagine, full implementation of this vision requires considerable funds. Please help if you can.

We call on all our partners, guests and supporters to materialise this vision. If you would like to become a financial partner of The Energy Autonomous Project, please get in touch. A detailed breakdown of the required finances, including the cost of each of the approaches described above can be made available on request. Thank you for your ongoing support – may we be the change we seek in the world.

### Contact:

Barbara Kovats, Janos Valder, Dr. Douglas Baillie  
Tamera / Testfield 1 / Monte de Cerro / P-7630-303 / Colos  
solarvillage@tamera.org Tel: (+351) 283623383  
[www.tamera.org](http://www.tamera.org)

### Account Information:

**Grace Foundation – America** (501c-3 status)

The Grace Foundation is a fiscally sponsored project of Inquiring Systems, Inc.

**Address:** 21885 Boness Rd, Sonoma, CA 95476

**Union Bank Account number:** 7960004390

**Routing number:** 122000496

**Payment Reference:** TEA

**[www.the-grace-foundation.org](http://www.the-grace-foundation.org)**

**Grace** – Stiftung zur Humanisierung des Geldes

**Bank:** Raiffeisenbank Zürich

**Bank account:** 92188.69

**Clearing:** 81487

**IBAN:** CH9881487000009218869

**BIC:** RAIFCH22

**Payment Reference:** TEA

Paypal and Credit cards: [www.tamera.org](http://www.tamera.org); link to [“donations”](#)



TAMERA



INGENIEURBÜRO SCHILLER



COME TOGETHER - COMMUNITY IS THE BASIS FOR SUSTAINABILITY

INSIST ON USING LOCALLY SOURCED ENERGY

IMPLEMENT LOW TEMPERATURE AND LOW PRESSURE TECHNOLOGY FOR THE PRODUCTION OF ENERGY.

COOKING WITH SOLAR MIRRORS AND TRANSFORMING ORGANIC WASTE INTO BIOGAS

USE SELF-REGULATING SOLAR ENERGY SYSTEMS FOR COOLING

CULTIVATE A NEW PARADIGM IN MACHINERY WHICH MIMICS THE FUNCTIONING OF NATURAL SYSTEMS AS MUCH AS POSSIBLE

INTEGRATE ENERGY PRODUCTION INTO THE DESIGN OF HUMAN STRUCTURES

ABANDON THE CONCEPT OF GLOBAL, CENTRALLY CONTROLLED 'ONE WAY' CIRCUITS AND MOVE TOWARDS DECENTRALIZED REGIONAL CIRCUITS THAT SERVE LOCAL COMMUNITIES.

CREATE OPEN SYSTEMS WHICH CONTINUOUSLY FEED ENERGY SURPLUS BACK INTO REGIONAL GRIDS.

COMBINE SYSTEMS TO ELIMINATE THE CONCEPT OF ENERGY WASTE

ENCOURAGE AUTONOMY BY SUPPORTING LOCAL PRODUCTION AND FOCUSING ON REGIONAL RESOURCES AND COMMUNITIES.

SEARCH FOR CONTINUOUS IMPROVEMENT