Conception and implementation of a sustainable electricity infrastructure in the Chã das Caldeiras on the island Fogo

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1. Introduction

This research deals with the electricity infrastructure of the Cape Verdean island Fogo. The Focus here is the region Chã das Caldeiras which lies submontane of the Volcano Pico do Fogo. Over the last 20 years it erupted twice and destroyed the villages in the Caldeiras area including the whole infrastructure. Afterwards the people returned and rebuild their homes. At the moment the electricity supply is secured by fuel generators, which contradicts the government's goal of using 100% Renewable Energy until 2020. The question is to what extent is it possible to implement an electricity supply which supports the government's plan as well as meeting the needs of the inhabitants of the Caldeiras?

2. Theoretical Foundations

For our research it is important to differentiate between energy and electricity. Energy can occur in different forms (mechanical, thermal, electric energy etc.) and can be transferred into every other form without any loss. Electric energy can be used to produce electricity, which is needed to use electronic devices. The difference is that during this process energy gets lost.

There is also an important difference between on-grid and off-grid supply. While households that have on-grid supply are connected to the electricity network and get their electricity from a central power station, the households that are off-grid do not. Instead they are responsible for their own supply through small scale systems. Off-grid supply is often used in rural areas, where the implementation of a grid system is not possible or too expensive.

3. State of Research

The Government of Cape Verde developed an energy plan (Cape Verde Energy Policy) in order to guarantee the energy supply in the future. Part of this plan is the aim that until 2020 100% of the electricity shall be produced out of renewable energies. So far, Cape Verde mainly uses fossil fuels such as oil and gas, which has to be imported and distributed to the different islands. This is one of the reasons why the price for fossil fuels has increased a lot over the last years. In order to be independent from these prices, other countries and to cover their energy demand on their own they have set the goal of producing electricity from renewable sources only. Gesto Energy (2011) investigated areas on the Cape Verde where the implementation of renewable energies is possible (On Fogo: wind, solar and geothermal energy).

4. Methodology

The main method in this research consists of qualitative interviews with people on different political scales. The lowest scale is the people living directly inside the Chã because they are the ones for whom the electricity supply is important to cover their needs in daily life. The middle scale is the administration of the island's capital São Filipe. They represent the link between the people in the Chã and the government of the Cape Verde Islands in Praia which is also the highest scale. The questions were clustered in upper categories (Government Goals, Ecology, Economy and Electricity Supply) to interpret them concerning which clusters have an impact on the action of the agents. Based on the results of these interviews we made a SWOT analysis of some chosen forms of energy production for the Caldeiras. It is a graphic presentation of the **S**trengths, **W**eaknesses, **O**pportunities and **T**hreats of the different production forms.

5. Presentation of the Results

In the course of the research we held eight interviews with representatives of the three scales mentioned before. The table (Table 1) shows their evaluation in matters of how the upper categories effect the actions of the different interview partners in the strategy development. One can see that economic factors as well as the guarantee of electricity supply played an important role for all test persons. Different the ecological factors and the goals of the government which had almost no impact. They mainly influence the actions of the officials. For the inhabitants of the Chã it played a minor role or no role at all.

Table 1: Effects on Categories.

	Government Goals	Ecology	Economy	Electricity Supply
Subject 1 (Government Official in Praia)	+	+	+	0
Subject 2 (Government of Sao Filipe)	+	0	+	+
Subject 3 (Hotelier of the Chã)	–	+	+	+
Subject 4 (Inhabitant of the Chã)	+	–	+	+
Subject 5 (Inhabitant of the Chã)	–	+	+	+
Subject 6 (Inhabitant of the Chã)	–	–	+	+
Subject 7 (Inhabitant of the Chã)	–	–	+	+
Subject 8 (Inhabitant of the Chã)	–	–	+	+

Source: Own Editing.

The three most important energy forms in the Caldeiras are solar, wind and fossil energy. We made SWOT analysis for each of them with the criteria of installation costs, running costs, service, land use, efficiency and service life (Table 2). Even though all of them have advantages as well as disadvantages solar energy has the most positive points and only two

negative points which do not have a large impact. Therefore, it is the most suitable option for the Chã while wind and solar energy have too many risks and weaknesses.

Table 2: SWOT-Analysis for Solarenergy.

SOLARENERGY	STRENGTHS	WEAKNESSES
CHANCES	• Relatively low installation costs can be payed by people themselves. • Low running costs because just sunshine is needed. • Not much time and effort needed for servicing what is perfect for the Chã. • Low land occupation and can be removed in case of a volcano eruption.	
RISKS	• With good servicing it has a long service life but chance of insufficient servicing.	• Low efficiency because sun is only available during the day. Risk that other energy forms are needed.

Source: Own Editing.

6. Discussion of the Results

After the volcanic eruption the Government of Cape Verde did not play an active role in supporting the installation of electricity infrastructure on Fogo and especially in the Chã. The country's geographical position makes the project even more complex. Since it is impossible to implement a central on-grid supply for the whole country every island has to provide electricity for itself, which leads to much higher costs. In general, the financing of the infrastructure is the biggest problem. Nevertheless, the people are willing to organise and install solar panels by themselves and have already done so. Other than the literature proposed we found out that solar panels is the most suitable energy form for the Caldeiras because of the advantages shown in the SWOT analysis.

7. Conclusion

It has to be stated that our research is not representative. Our findings are only a first step and a starting point for further investigations. Nevertheless, based on our results we can give some recommendations for action:

1. Financial discharge through tax relief or credits to help people to afford solar panels and guarantee the electricity supply.
2. Direct support of projects by foreign investors (organisations, countries, etc.).
3. Distribution of knowledge about the running of electronic devices among the inhabitants of the Caldeiras.
4. Training of technicians for improvement of service through cooperation with the University of Cape Verde.

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