

## **Overview Of Brazilian Renewable Energy Research Groups: Actual State And Recommendations For Future Developments**

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### **Abstract**

This proceeding summarizes the results of a research that was carried out in several Brazilian institutions that works with renewable energies. It was developed in CEPEL ( Electrical Energy Research Center) supported by FINEP (Projects and Studies Support) and MCT (Technology and Science Ministry)

Based on the results it was possible to identify the main gaps in the knowledge of these energy sources in Brazil and draft new research ways and actions to increase the performance of the applications.

### **1. Introduction**

This proceeding summarizes the results of a research that was carried out in several Brazilian institutions that work with renewable energies. The considered energy sources were Photovoltaic Solar (PS), Thermal Solar (TS), Wind Energy (W), Biomass (BIOM), Biofuel (BIOM-BD), Biodigestors (BIOM-BG), Hydrogen (H), Small Hydro Power (SHP), Energy from the Sea (SP).

Based on the results it was possible to identify the main gaps in the knowledge of these energy sources in Brazil and draft new research ways and actions to increase the performance of the applications.

The work of the institutions and their experience was the base of this research. The survey came through from questionnaires, interviews, technical visits and workshops with representative people from the groups, enterprises and research centers. From 69 questionnaires send, 46 were returned. This is a 67% credit balance, which is an impressive amount. These results were discussed by the working groups, with representatives of the institutions and were complemented by suggestions during the workshops. The final document includes also the discussion about the Brazil's Renewable Reference Centers, their attributions, their functions and so on, which occurred at the VI Renewable Energy Permanent Forum, which was held in Brasília in 2008.

Brazil is recognized as one of the countries that have a higher potential to exploit renewable energy (RE). Some of these sources, like the large hydroelectric power and alcohol fuel, for example, are already in full commercial use, Another ones, as solar, wind, hydrogen energies and some biomass sources, for example, are very much bellow of its real potential. There are a lot of causes for this, depending on the type of the source: (1) technology costs; (2) ignorance of the source potential; (3) lack of technology maturity; (4) opposition in using new

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technologies; (5) lack of human resources; (6) need of more technologic development, among the others

In the latest years, a significant number of research groups in several institutions were created, in Brazil, to work with the many subjects of renewable energy. So, it is important to survey the group's profiles and the knowledge accumulated in these institutions to identify the possible gaps and the difficulties in the work development, in order to promote a technological development consistent to the renewable energy in Brazil.

The results of the survey have been used by MCT to discuss new policies and actions to the renewable energy field.

## 2. Summary Of The Acquired Information

In the sequence will be showed the synthesis of the information obtained from the questionnaires and interviews

It was verified that the most portion of the surveyed institutions were in southeast region (50%), more than the double of the other regions. Considering the great RE potential unexplored in these other regions, it is important to increase the interchange between the southeast and the other regions. This interchange will propitiate mutual improvements.

The most portion of the surveyed institutions (73,9%) have started its RE activities since 90's decade and only 26,15% started its activities between 1971 and 1990. This shows the greatest concern about RE in the last years, as by the reducing of the traditional energy sources as by environmental issues and, indicates too, the need to ensure, keeping or enlarging the resources for RE, so that the technologic patrimony represented by these groups have continuity.

The greatest work areas in all the surveyed institutions are shown in table 1.1

Table 1.1 The greatest work areas in all the surveyed institutions

Photovoltaic Solar	Biomass	Wind Energy	Thermal Solar
21,53%	15,97%	15,28%	14,58%

The most important work areas in the surveyed institutions are shown in table 1.2

Table 1.2 The most important working areas

Photovoltaic Solar	Thermal Solar	Biomass	Wind Energy
26,97%	19,10%	16,85%	15,73%

The most important activities developed in the surveyed institutions are shown in table 1.3

Table 1.3 The most important activities developed in the surveyed institutions

Researching	Publication	Technologic Diffusion	Qualification	Consultancy
17,78%	14,44%	13,33%	12,78%	12,78%

The most portion of the projects in the last five years in these institutions were in Photovoltaic Solar (25,45%). The greatest portions of the projects that are being developing at the moment of the survey are also in Photovoltaic Solar (21,82%). The great part of them is of simple systems implantation, and few institutions have large research projects in this area.

Comparing the types of developing projects in the last five years with the types of the projects developing now, it can be seen an evolution.

The most named difficulties by the surveyed institutions are shown in Table 1.4.

Table 1.4 Difficulties most named by the surveyed institutions.

Financial resources are not distributed regularly	11.72%
Lack of Human Resources	9.38%
Difficulties to keep specialized people	9.38%
Too much Bureaucracy	8.59%
Lack of Financial resources	8.59%
Lack of Financial resources to the laboratorial structure	7.03%
Lack of scholarships	5.47%
Financial resources are not enough to the general structure	4.69%
There are not integration between the institutions	3.13%
The way to evaluate and approve the projects by the assistance institutions are not clear enough	3.13%

As a general rule, these difficulties are associated to the amount and regularity of the financial and human resources and to the excess of bureaucracy to get them. As there is no regularity in financial resources, this causes the problems in obtainaing and keeping specialized people to work. This is a critical problem.

The total of human resources involved in RE projects in the surveyed institutions is 595 people., where 35,63% Dsc, 27,9% Msc and 5,38% college graduated.

Having in mind the RE Brazil´s potential, the number can be considered low, according to the second greatest difficulty:There is not enough specialized people to work.

### 3. Diagnostic and Suggestions

Following the survey it was possible to identify some most critical points that must be worked out. These points and suggestions to fix the problems are enumerated in the sequence.

1. Long term projects and specific projects for a bigger infrastructure but linked to the research projects, may contribute to give more security to the research groups, allowing increasing the number of specialized people to work and to keep them.
2. Multi institutional projects must be developed to promote the institutions integration. These projects must be developed between institutions from different regions in order to promote the knowledge diffusion uniformly around the country. It may be required the participation of institutions less developed with other ones more developed or between groups more consolidated with other ones less consolidated. Exceptionally it can be reduced the requirement of the project manager degree from Dsc to Msc.
3. The development of technological nets is considerate fundamental, but they are not simple to develop. They need resources to their planning and operation process in order to be appropriately done. Specific requirements to the nets development must be implemented, but must be made an initial choice about the subjects considered that have priority to build the pilot nets. It can be promoted, initially, workshops where managers

- of well succeed nets in Brazil, even if from different energetic areas, show the problems and solutions they were faced in order to orient the development of the RE net.
4. Too much bureaucracy was identified as a considerable problem. To control the good use of the public finances with agility is an important point. An effort to simplify the access to the financial resources, using more efficient control processes, but giving up requirements that are not absolutely necessary must be done. Accepting projects of longer duration, higher than two years, helps to dilute the unavoidable bureaucracy, which has a significative importance in the period of the short duration projects.
  5. A periodical and systematic evaluation of the work results from the different groups may also make easy the financial resources distribution. Quantitative and qualitative targets to the projects evaluation, both financial and technical indicators, must be used.
  6. The amount of human resources working in RE is still insufficient and we can see a concentration of these resources at the Dsc degree. Because of this it is important to stimulate activities that motivate students for RE area, as so scientific dissemination activities, disciplines in college graduation, trainee programs, and so on. It is desirable to increase the number of scholarships. It is important also, to set specific public competitions for RE area in order to keep specialized people. It is important to create an inter-institutional Msc for RE area as so, energy and environment graduation and post-graduation courses.
  7. It is important that the sectorial funds projects are allowed to afford international cooperation.
  8. It is very important to create at the governmental agencies specific groups for RE. At the present the RE projects are analyzed in other groups not specific, at a loss for RE development.
  9. A table that can be found in an extended version of this article at [www.cresesb.cepel.br](http://www.cresesb.cepel.br) , synthesizes various activities and research lines indicated as relevant to been developed in the next five years. It is recommended that it is the base to the elaboration to new programs.
  10. The rule of Reference Centers, specialized on diverse RE, according to this work, is considered relevant. But, to avoid using that denomination by any groups, it is necessary to define better the concept of “Renewable Reference Center” and also their “modus operandi”. At the original work, can be found a proposal Reference Center concept and also how they are expected to work, that has to be understood as a contribution to a final decision under responsibility of MCT.

#### **4. Conclusions**

The information found at the CEPEL-FINEP-MCT research, summarized here, can be used to draw actions in the sense of speed up the development of RE sources in Brazil.

The identified difficulties, and the proposed solutions, were well discussed and represents a consensus among the researchers consulted.

The complete report that was a base of this work, is available at MCT and has been used as a reference in subjects related to new RE.