

Energy for Poverty Alleviation in Sahel

Intelligent Energy Project

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Renewable energy resource assessment – valuable tools for African energy stakeholders

Renewables constitute a reliable and environmentally sound long-term alternative for practically all African countries and many have abundant and unexploited biomass, solar, wind and hydro resources. What is still unclear is the extent to which renewables can assist in addressing the energy needs of Africa's poor—mainly due to the lack of reliable and accurate data regarding renewable energy potentials

In this newsletter issue of the IE4Sahel project we present two important tools that can be used by stakeholders in the renewable energy field in order to accurately assess the potential for RES investments in a specific region, taking into account detailed quantitative information and using calculation tools. They were also presented at the 1st First Workshop in Niamey, 2-6 October 2006, at the Centre Regional Agrhymet.

Tool No. 1 - Methodology for developing an integrated Regional RES Plan

This methodology can be used to document and utilise the RES-related findings for any given region. These findings include:

1. the assessment of the potential for RES investments in the region, taking into account detailed quantitative information and using calculation tools.
2. the adoption of targets (in the form of new installed capacity, number of new RES projects per region etc..) as Optimal RET mix scenarios.
3. the identification of potential technical and non-technical barriers to the achievement of these targets
4. the formulation of an integrated action plan for RES development in the region

The basic parameters affecting RES exploitation and investment prospects in a given region are:

- The existing RES potential (wind velocity, water flow, solar irradiation, available biomass quantities, geothermal areas)

- RES technologies characteristics (efficiency, availability, cost etc...)
- The existing required infrastructure (roads, electricity networks, etc)
- Administration, legislation & promotional means (administrative procedures for new projects, electricity prices, subsidies etc...)
- Financial aspects (costs and benefits, profitability of investments etc...)

To achieve a reliable assessment of RES prospects in a region, the following three (3) main steps are applied:

- Detailed survey of current situation, this includes investigation of:
 - S1 Legislative framework for RES.
 - S2 Status of the electricity market.
 - S3 Status of RES development in the region.
 - S4 Existing infrastructures.
 - S5 Acceptance by local society, public participation.
 - S6 Licensing Procedures – Investments environment.



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- Analysis of RES potential & investigation of alternative RES development scenarios, this includes:

P1 Mapping of the theoretical potential for each RES – regional databases have to be created for Sahelian countries ASAP.

P2 Investigation of technical and environmental constraints for RES projects development .

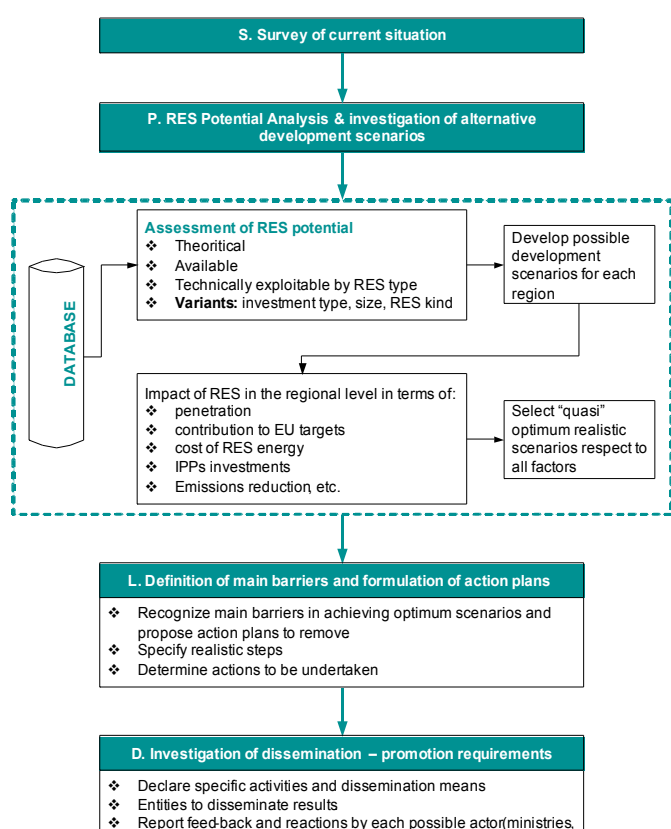
P3 Investigation of cost & benefit parameters (analysis of production costs, profitability analysis, sensitivity analysis).

P4 Development of realistic scenarios for RES project development -Formulation of an 'Optimal RET mix 'scenario – adoption of targets.

P5 Impact assessment for the RES development scenarios (impact on environment, creation of new jobs, regional development, quality of life etc...).

- Definition of main barriers & formulation of a regional RES plan

Figure 1: Diagramme of Methodology for regional RES planning

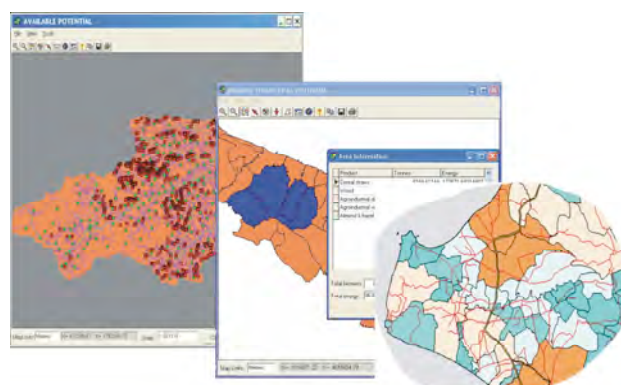


Tool No. 2 - Geographic Information System (GIS) for the assessment Of The Technically And Economically Exploitable RES Potential

The main aim of the tool is to provide valid information for the availability, exploitability and economical efficiency of the electricity production from RES. The tool is giving special attention to the geographical dispersion of RET's within a large area and facilitates the user by providing useful and easy-to-understand thematic maps.

The system is allowing the user to:

- Estimate the prevailing (theoretical) potential of each RES within the selected area
- Estimate the technically exploitable RES potential within the area
- Estimate the most economically attractive RET's in each location
- Estimate the infrastructure required (electrical network, roads etc) for the RET's installation and the associated costs
- Analyse the impact of the existing legislative framework (mainly incentives, fiscal measures etc.) on the economic viability of private investments in RET's
- Evaluate the RES penetration in extended geographical areas for further use in strategic energy planning.



Screen examples (from left to right):

- Available Wind Potential for Installations (to get this various queries have been applied to the theoretical potential, e.g. security & regulations, technical, environmental, infrastructure networks),
- Biomass Theoretical Potential (Product Type, Tonnes, Energy),
- Presentation of Biomass route from parcels to plants

The innovations introduced in the tool developed can be summarised as follows:

- Development of an integrated methodology that takes into account all the parameters affecting the performance of RES in a consistent way.
- Applications of the methodology in large geographical areas following a GIS approach.
- Detailed simulation of both, the RES generating units and the electrical networks.
- Detailed analysis of the impact of RES on the electrical networks so as to give the user the ability to estimate the network infrastructure required for the RET's exploitation in large scale.

The system supports the following RES:

- Wind
- Hydro
- Solar
- Biomass

The input of the system comprises of:

- The theoretical potential of each RES
- Geographical data
- Electricity network data
- Technical and economic data concerning existing RET's
- Legislative framework parameters
- Information for the financial environment for private RES investments

The tool treats each RES separately. Also, the analysis is focused on a specific geographical area (specified by the user). For each RES in a pre-selected area, the system reports a variety of results and information, which have been classified in five sections as follows (see System Operation – Outline figure):

System Results & Information:

- Theoretical Potential
- Available Potential

- Technically Exploitable Potential
- Economically Exploitable Potential
- Prefeasibility Analysis of RES investments

The approach described above is based on the idea that the portion of the energy content of renewables, which can be transformed into electricity, is constrained (hierarchically) by:

- The available potential and the corresponding land for installations.
- The existing technologies for RES exploitation and their efficiency
- The economic feasibility of RES, which is influenced by various factors (cost of RET's installation, existing network infrastructure etc).
- The legal framework regulating the RES sector, which has been proved to be a crucial factor for the RET's penetration into the energy system. The last section, which performs pre-feasibility of RES investments, has been included in the tool in order to support the impact analysis of legislative regulations in a "regulated" market in RES (such as the one foreseen for EU Member States).

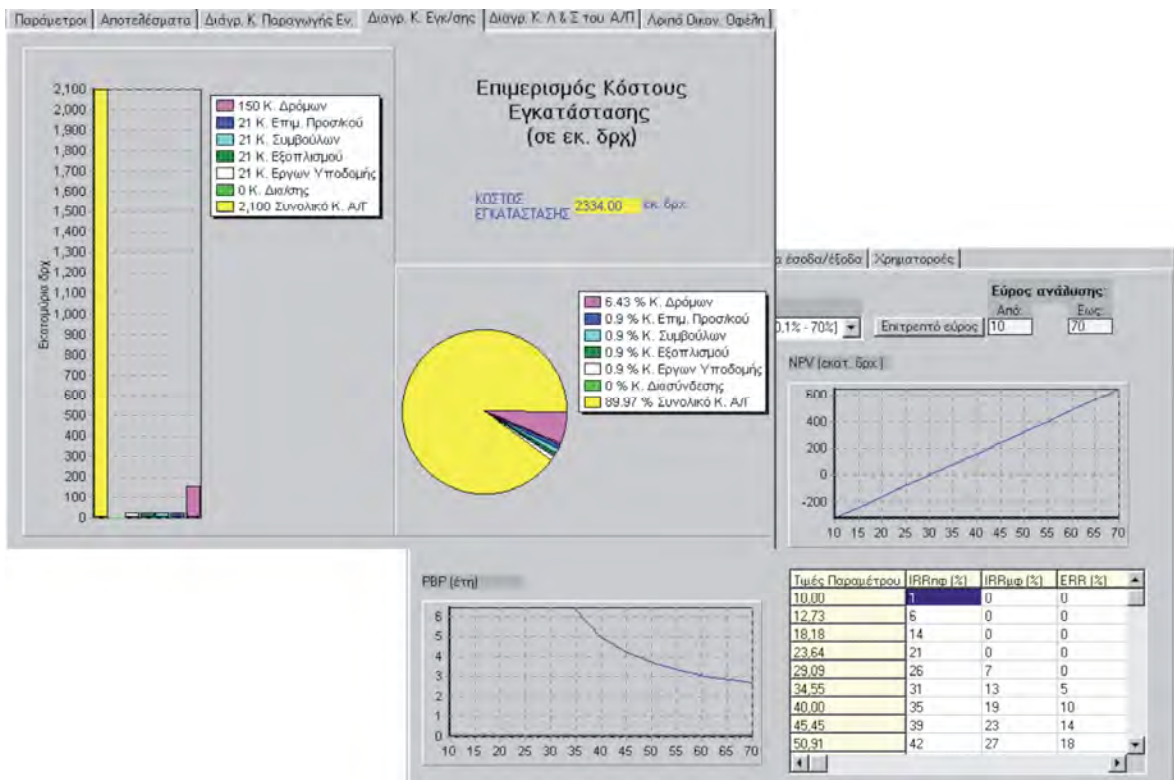
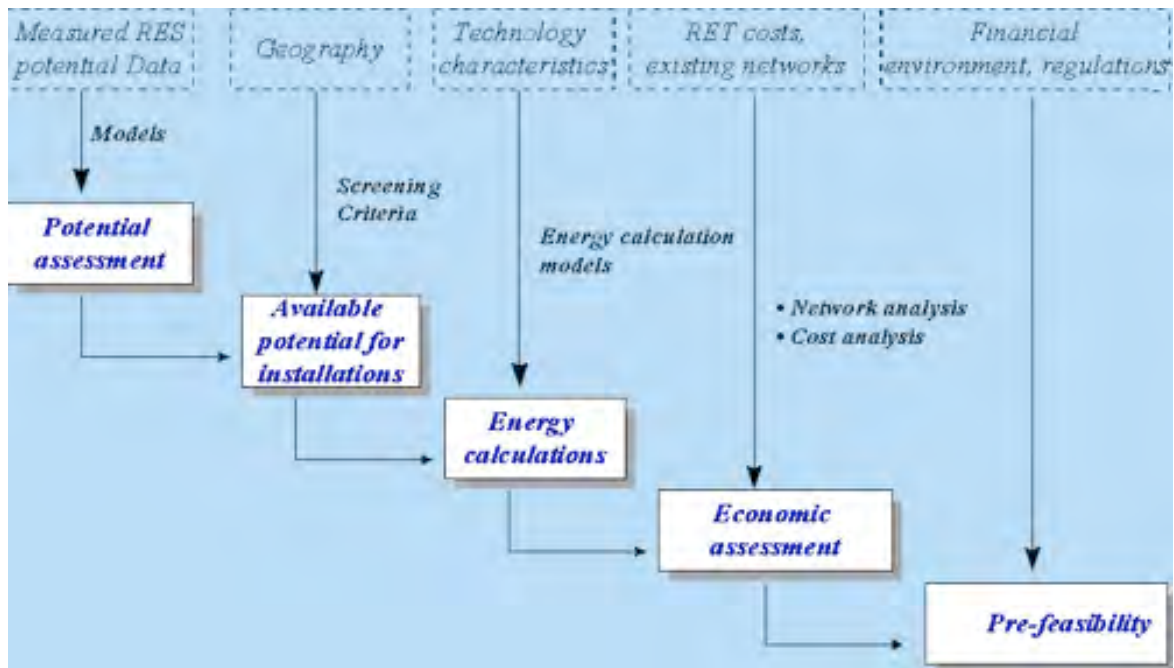
References

Both tools were developed for/ during:

- The assessment of the technical and economical potential of RES in Greece (National Operational Programme for Energy - www.cres.gr/kape/datainfo/maps.htm)
- A Planning Tool for the Optimal Regional Integration of Renewable Energy Sources – OptiRES (Altener Contract No. 4.1030/Z/01-089/2001 - www.optires.info)

, by the Centre for Renewable Energy Sources - Division for Energy Information Systems Dissemination & Market Development.

System Operation – Outline



Screen examples of the Financial Analysis tool of the system for a wind farm (left to right):

- Production Cost Module/ Installation Cost Window: total & breakdown (W/T cost, roads, staff, consultants, equipment, grid connection, infrastructure projects etc.),
- Investment Analysis Module/ Parametric Analysis Window – using the investment subsidy factor as the parameter, the results are Internal Rate of Return, Pay Back Period (years), Net Present Value.

Project Schedule

The project is scheduled to be developed until mid-2007, with the realisation of two main Workshops, from where the project team already ask for interested parties to mark in your agenda.

1st Workshop - 3 - 6 October 2006 – Niger

2nd Workshop - March 2007

Besides these two Workshops the project is also committed to involved institutions to build a permanent network between the professionals

Istituto Superior Tecnico RGESD - IST Portugal	ESD - Energy for Sustainable Development Ltd UK	CRES - Center for Renewable Energy Sources. Greece	ARC - AGHRYMET Center Niger
Long experienced research team in the field of energy planning and renewable energy systems.	Consultant firm with experience in energy policy and regulation.	The Greek national centre for Renewable Energy Sources, Rational Use of Energy and Energy Saving.	Specialised institution committed with the food security and to help the management of natural resources in the CILSS region..

The Project Team

How to contact the Project Team

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☐ I am interested in the IE4 Sahel project. Send me an invitation for public meetings about IE4 Sahel.

☐ Please add only my name to the mailing list and send me more information about IE4 Sahel

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