Collaborative Project

CLIM-RUN

Climate Local Information in the Mediterranean region Responding to User Needs

WP 7: Renewable Energy

MONTH 6

D 7.1, Workshop Report
MS32, Workshop Organisation
MS34, Survey Organisation

Project No. 265192, CLIM-RUN

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Author: Melanie Davis, Paco Doblas Reyes, Peter Schmidt, Sandro Calamanti, WP7

Summary

This document provides an overview of what has been learnt and what has been achieved within work package 7 for renewable energy, over the first 6 months of the CLIM-RUN project.

In total, seven workshops have been completed by the group. Three of these workshops were organised and run by CLIM-RUN WP7 members, and took place in each of the case study countries (except Cyprus): Morocco, Croatia and Spain.

Several insights related to the use of, and need for climate information within the RE sector have been gained, among others:

- very few RE stakeholders have considered the use of seasonal to decadal climate information,
- RE stakeholders consider technological and regulatory risks to be more important than climate risks,
- a better understanding of the climate variability could help to facilitate the bankability of RE projects,
- wind speed and DNI are key parameters for which RE stakeholders would require reliable analyses.

As it is crucial to engage RE stakeholders in the concept of climate variability by, for instance, providing examples on how climatic variability in the past has affected the potential of renewable energy production, the next stage of the CLIM-RUN project will see the development of climate research and climate services specific to the needs of RE stakeholders (outlined in section vi).

Description of deliverable D7.1 (Extract from CLIM-RUN ´´Description of Work´´ document)
Workshop report: Workshops report on renewable energy: context and objectives, comparison of data supply and demand, simulation results, feedback and discussion (Task 7.1) [month 6]

i. Context

Extract from CLIM-RUN ´´Description of Work´´ document:
Objective 7.1 is the *organisation of periodic meetings* with researchers involved in the design and management of solar, hydro and wind power plants to exchange knowledge about the *usefulness and limits of future climate information*, *review international standards* guidelines *for the use of meteorological data by the energy sector, discuss the climate parameters that affect the installation of these plants, the climate uncertainties at different temporal and spatial scales and the propagation of these uncertainties from the climate information to the estimates of energy production.*

ii. Objectives

Organisation of periodic meetings: In total, 7 workshops have been completed by the group to date. 3 of these workshops were organised and run by CLIM-RUN WP7 members, and took place in each of the case study countries (except Cyprus): Morocco, Croatia and Spain. Approximately 100 renewable energy (RE) stakeholders attended the workshops or were communicated to via external ´´workshop´´ events. The workshops focused mainly on energy stakeholders involved in the promotion, consultancy or management of RE power plants, and some stakeholders involved in the design.

Usefulness and limits of future climate information: Overall feedback indicated that very few RE stakeholders had even considered the use of seasonal to decadal climate information, believing that it is a ´´crystal ball´´ theory (i.e. highly unpredictable). This does not mean that such forecasts would not be useful to the RE sector, but there is an additional challenge to overcome this preconception.

Usefulness: A better understanding of the climate variability over future timescales would help RE stakeholders to manage one of their key risks: the predicted energy yield of a RE power plant and therefore its cash-flow analysis and bankability over the full investment time-frame (between 1-15 years). In addition, robust climate data would help RE investors to identify the best location for future project development, which will become increasingly complicated as

RE´s contribution to primary energy targets increases over coming years and the ´´best locations´´ are utilised. Finally, analysis of the future frequency and duration of climate extremes would be particularly useful to the RE investor and insurance stakeholders, as these represent time periods when there is potentially low, or no return on investment. The key extreme variable is high wind speeds, which affects both solar and wind projects, although extended periods with high cloud cover, low wind speeds or low precipitation can also be detrimental to independent solar, wind and hydro projects respectively. The time period of greatest risk is the early phase (first few months/years) of a RE investment project.

DNI is another key variable for which reliable information on both the present and future high frequency (say hourly) variability is generally lacking. Note that relatively small differences in the evaluation of potential annual production may result into large differences in the return of investments over time scales of 20 to 30 years. In this perspective, a significant knowledge gap concerns the high frequency variability of atmospheric aerosol.

Limitations: Robust climate information at seasonal to decadal timescales represents only a fraction of the challenges and risks involved in the RE sector. Technological limitations, or unstable governmental policies are currently considered to be the greatest risks to the RE stakeholder. The need for site-specific weather information is critical to project development, and to date, most of the meteorological research has focused here. Although RE energy models are used to estimate a project's energy yield, where an understanding of climate variability over longer timescales in the past is included, the accuracy and value of these analyses is limited as different models commonly show varying results because the quality of climate data is not consistent. Some RE energy models are free whilst others must be paid for; although RE stakeholders often use the cheapest model, accepting that the results could have high margins of error. It has also been noted that, despite this inaccuracy, it is very difficult to get RE stakeholders to change their methodologies now that they are established within the sector.

Review international standards and guidelines:
Most RE investors currently require on-site analysis of climate information for a minimum of 1 year. There does not seem to be further standards or guidelines that are needed within the RE sector at this stage, however this is likely to change as the sector grows. A change in this direction is indicated by the recent implementation of a new directive by the German government, which requests RE project evaluators to pay attention to the climate dimension for energy projects in Morocco.

iii. Data supply

RE stakeholders primary use of meteorological research is related to site-specific weather information. This information is gained by setting up a basic weather station at chosen sites and collecting information over the course of approximately 1 year.

Energy models are also used to compare this on-site data to longer timescales, although such models have considerable limitations as outlined above. These energy models use climate data from the past.

To date, no future climate information for seasonal to decadal timescales is used within the RE sector.

iv. Data demand

Climate parameters that affect the installation of RE plants:

For seasonal to decadal timescales, RE stakeholders require the following information:
https://docs.google.com/spreadsheet/ccc?key=0Ak-vXfiZiAgwdERYdkFZdFdIdUxKc29aWVBKNHNzclE#gid=0

Climate variables
SOLAR : Solar radiation GHI ; Solar radiation DNI.
WIND: Wind intensity at different heights (80-100m); Prevailing wind direction; Wind speed variability.
SOLAR AND WIND: Extreme wind speeds (>35km/hr) - frequency of such winds and their duration.

HYDRO: Precipitation - also the frequency of high rainfall events and their duration.
GENERAL: Hailstorms / Snow cover - frequency and duration; Humidity; Aerosol variability; Temperature.

Temporal and spatial scales:

Spatial scales
Mediterranean region as a whole; Each of the case study regions (Spain, Croatia, Morocco, Cyprus); Regional geographies within each country; RE project site-specific locations (tbc.).

Temporal horizons
Historical variability (over past 1, 2, 5, 10, 20, 30 years); Future predictions (over next 1, 2, 5, 10, 20, 30 years).

Temporal resolution
Monthly, seasonal and annual variations over 5 years, 10 years.
There is also a need for very high resolution data (for example hourly), where viable.

v. Simulation results

Initial simulation results have been generated by:

Spain, IC3, over the Mediterranean for 10m wind, solar GHI and temperature, at temporal horizon of 2010-2015 alongside verification of the forecasts for the period 2005-2010.

http://www.climrun.eu/egroupware/webdav.php/home/melanie.davis/20110901_Initial_results_climrun_WP7.ppt

Croatia, DHMZ, over Croatia for solar GHI (cloud cover change), 10m wind, snowfall and temperature, at temporal horizon of 2011-2040 and 2041-2070 (results included within the following draft paper: http://www.climrun.eu/egroupware/webdav.php/home/melanie.davis/Assessment_of_Climate_Change_Impacts_on_Energy_Generation_Croatia%20.pdf

vi. Feedback

As there is little or no climate data available for the RE sector, and little consideration has been given to date to the future variability of climatic resources affecting a RE power plant, it is important to start from the basics to develop a climate services protocol for this sector and build awareness and trust between climate scientists and RE stakeholders. Initially, it will be important to engage RE stakeholders in the concept of climate variability by demonstrating some of the following:

- that climate variables related to the RE sector (solar, wind, temperature etc.) has varied over the past and will vary in the future, both naturally and from anthropogenic climate change (following the IPCC scenarios).
- that climate analyses for a specific site, from a single year, could be highly unrepresentative of the inter-annual climate resource availability (e.g. if the analyses falls during a significant phase of a climate pattern or phenomena).
- a simple description of the skill that is available by using different climate forecasts, i.e. the differences between analogue, statistical and dynamical forecasts. Example paper: http://www.climate-development.org/atroccoli/nato_arw/arw_book/Climate_Energy_Book_Troccoli_CH15_Mailier.pdf (n.b. although this level of information could be important, the main focus should always be on what, not how). Add link to model comparison presentation when available
- an explanation of how the accuracy of the energy model results, currently being used in the industry, could be improved using seasonal to decadal forecasts.
- to present all climate information in the context of energy generation and economic impacts on RE project investments (e.g. using case study example).

vii. Discussion

Propagation of uncertainties from the climate information to the estimates of energy production:

As previously mentioned uncertainties of climate information within the RE sector is already seen to greatly affect the estimates of energy production, although the sector has grown, knowing and largely accepting this limitation.

A challenge for CLIM-RUN will be to demonstrate that improvements can be made to such climate uncertainties, in order to manage the investment risk of a RE project as much as possible. This information will be most valuable to the investment, insurance and policy-related RE stakeholders, and least valuable to RE technology or project designers.

To truly engage RE stakeholders in a seasonal to decadal climate services protocol, efforts will need to be made to explain the basic methodology, the opportunities and limitations of climate forecasts at such timescales (via climate forecast results, including quantifiable probabilities and RE project case studies), its role to fill the ´´knowledge gap´´ of future climate trends and the value of such forecasts when used alongside both the current improvements in short-term weather prediction skills and the established, although limited accuracy of RE project modelling software.

ANNEX

Workshop reports to date:

- WP 7 Energy Case Study, Morocco Reports (ENEA, PIK, PLAN BLEU): MENASOL 2011 conference report (/egroupware/webdav.php/home/peter.schmidt/20110526_MENASOL%20REPORT.doc) and Workshop Casablanca report (/egroupware/webdav.php/home/peter.schmidt/20110526_CASABLANCA%20WORKSHOP%20REPORT.doc)

- WP 7 Energy Case Study, Spain Report (IC3): Genera 2011 exhibition and conference: /egroupware/webdav.php/home/melanie.davis/20110516_Genera%20Report_CLIMRUN.pdf

- WP 7 Energy Case Study, Spain Report (IC3): CLIM-RUN Workshop: www.climrun.eu/egroupware/webdav.php/home/melanie.davis/20110530_Academic%20Workshop%20Report_CLIMRUN.doc

- WP 7 Energy Case Study, Spain Report (IC3): Renewable Energy World 2011 exhibition and conference: http://www.climrun.eu/egroupware/webdav.php/home/melanie.davis/20110610_Renewable%20Energy%20World%20Report_CLIMRUN.doc

- WP 7 Energy Case Study, Spain Report (IC3): Renewable Energy Insurance & Risk Management Conference: http://www.climrun.eu/egroupware/webdav.php/home/melanie.davis/20110706_Renewable%20Energy%20Insurance%20&%20Risk%20Management_CLIMRUN.doc
  PDF: http://www.climrun.eu/egroupware/webdav.php/home/melanie.davis/20110706_Renewable Energy Insurance & Risk Management_CLIMRUN.pdf

- WP7 Energy Case Study, Croatia Report (DHMZ, UNDP): CLIM-RUN Workshop