Report On

Energy and climate information services

Fellowship

Fellowship period: January 2017 to March 2017

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Energy and climate information services fellow

African Climate Policy Centre (ACPC)

United Nations Economic Commission for Africa (UNECA)

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1. BACKGROUND

The African Climate Policy Centre (ACPC) is a hub for demand-led knowledge generation on climate change in Africa. So the ACPC is an integral part of the Climate for Development in Africa (ClimDev-Africa) programme, which is a joint initiative of the United Nations Economic Commission for Africa (UNECA), the African Union Commission (AUC), and the African Development Bank (AfDB). The fellowship programme is a capacity building initiative in Africa by the African Climate Policy Centre (ACPC) of the Economic Commission for Africa, under implementation of the pan-African component of the Weather and Climate Information Services for Africa (WISER) programme in the pilot phase. I joined the fellowship programme as energy and climate information services fellow at the beginning of January 2017. It is believed that weather and climate variability impacts the potential of annual energy production of wind, solar and hydropower renewable energy project sites. This assessment can be an enabling factor for the development of an analytical framework that examines the nexus between renewable energy, and weather and climate variability and uncertainty.

2. FELLOWSHIP RESPONSIBILITIES

As a research fellow in energy and climate information services, my duties and responsibilities were to (i) compile case studies to assess weather and climate variability impacts on the potential annual energy production of selected renewable energy project sites (wind, solar and hydropower), (ii) to develop an analytical framework for assessing the nexus between renewable energy and weather and climate variability and uncertainty, with a view to contributing to assessing the socio-economic benefits of climate information services, (iii) assess the needs and gaps of institutional and individual capacity for energy planning with integrated climate information services and develop material for capacity building of energy planners to mainstream climate information and information services into energy planning with increased shares of renewables, and (iv) to compile guiding principles for good practice in mainstreaming climate information services into energy planning. I had the opportunity to work with RCMRD (Kenya) to further elaborate the GIS output of the mapping exercise and develop joint material and framework for the capacity development aspect.

3. PROJECT RESULTS/OUTPUTS

So far I have compiled case studies on solar and wind energy on Africa with emphasis given to selected countries such as Ethiopia, Kenya, Morocco and South Africa; which will enable energy planners and decision makers to gain a better insight on the status of the projects. Therefore, It was understood that to further aid the understanding of the aforementioned parties, compilation of data on solar and wind energy, which focused on identifying location, technology name, capacity, capacity factor, number of turbines, current operational status, investment, as well as geographic coordinate location and year of its commencement had been packaged for an open access data source.

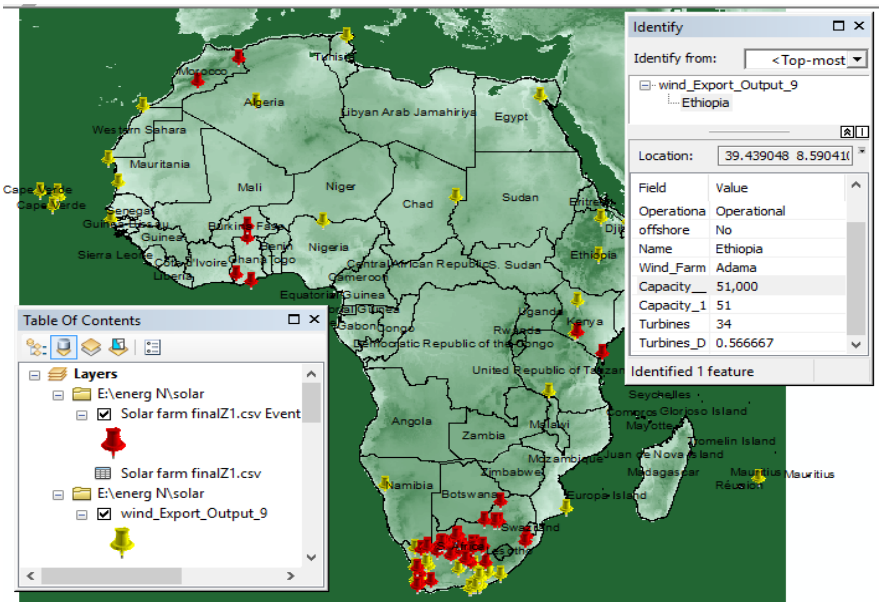

Figure 1. Map showing data on renewables

After the data compilation, the next step was proceeding to data mining for existing energy resource maps such as wind speed, Global Horizontal irradiation and Direct Normal Irradiation and overlaying them with the previously compiled data. For this process ArcGIS was used for data projection as well as integrating data with other energy resource layers within a common coordinate framework. For instance the overlaid sample image of the GHI done for South Africa is exhibited below.

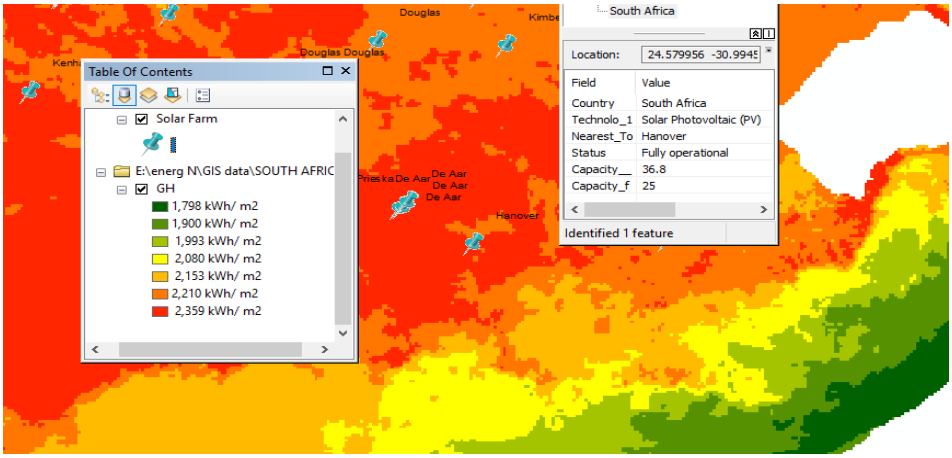

Figure 2 Map showing solar energy sites GHI in South Africa

So the processes which were explained previously were performed so it can help understand about the existing situation and serve as a guide for future renewables installation. As the sample section of the map depicts, most of South Africa's solar energy should be located on the red area rather than the green one because the solar irradiation is at its optimal on the red area. But overall, it has been found South Africa has a good potential for solar renewables investment.

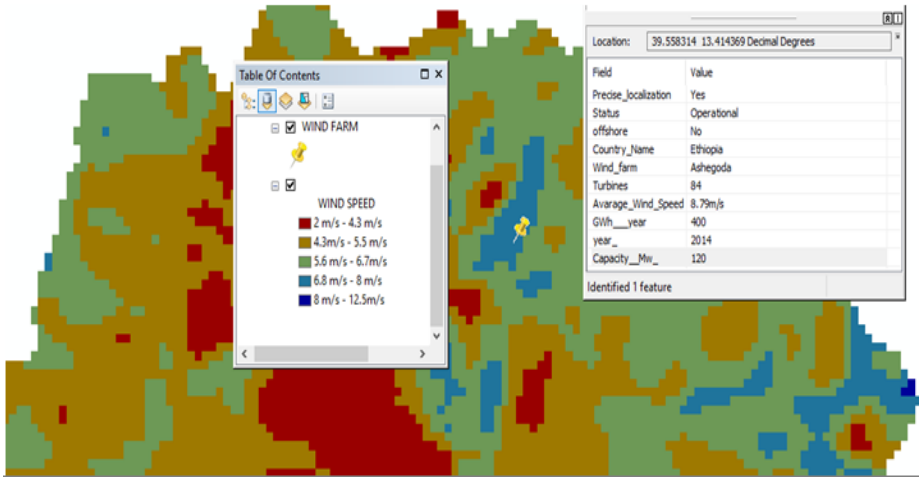

Figure 3 Map showing potential Wind speed in Ethiopia

This sample section shows, the areas that are designated with the dark blue and blue are areas which have the highest wind speed. As such this map enables the energy investor to easily identify the suitable areas for wind farm investment. This particular sample section of a map is the Ashegoda wind farm which is located on the northern part of Ethiopia which was placed with the consideration of the wind speed.

Hereafter, in order to identify the nexus between renewable energy, climate and weather, I continued working on ArcGIS. For these a broader data mining process was performed to

collect data that were deemed important. These data incorporates: Global Horizontal irradiation, Direct Normal Irradiation, wind speed, annual average temperature, annual average precipitation, sunshine duration, annual average cloud cover.

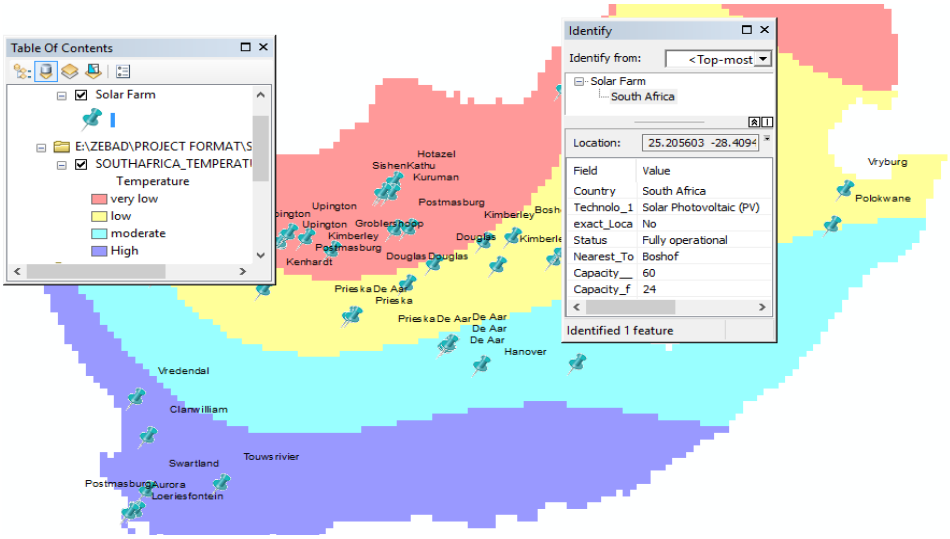

Figure 4 Map showing Cloud cover on solar energy sites in South Africa

This was used as a stepping stone for preparing suitability analysis by utilizing climate and weather information data coupled with other environmental data to pinpoint potential sites for renewable energy installation. Data mined includes: land use, soil type, protected areas, water bodies, topography, slope, vegetation cover, hill shade, Global Horizontal irradiation, Direct Normal Irradiation, ground water, earthquake frequency, land slide, wind speed, annual average temperature, annual average precipitation, sunshine duration, annual average cloud cover giving emphasis to Ethiopia, Kenya, Morocco and South Africa. As seen below the criteria were classified into three categories: environment, climatology and meteorology.

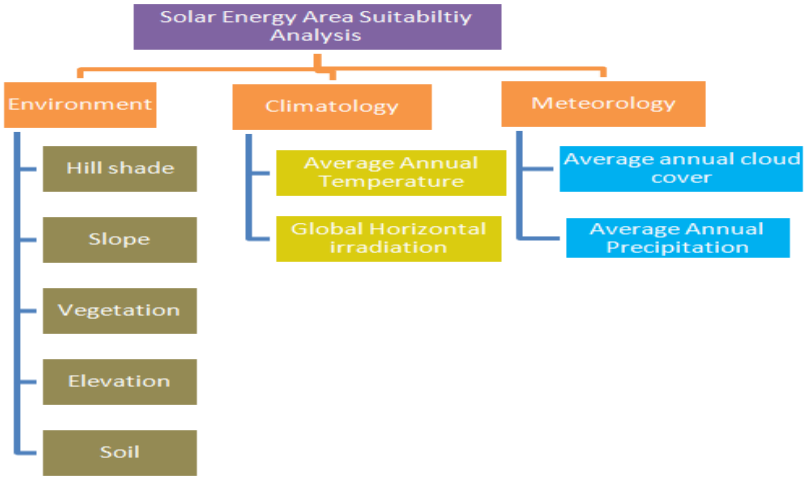

Figure 5 Criteria used for suitability analysis

Next, by overlaying these criteria, the final map of the suitability of different areas for exploiting solar energy farms has been developed for South Africa.With this in mind, indicators considered important for the process such as vegetation cover, slope, hill shade, solar irradiation, precipitation and total cloud cover were taken. As seen below after areas had been identified they were categorized as excellent, moderate, low, and poor level. As such, areas in South Africa that are identified as excellent must be positioned for exploiting solar energy farm.

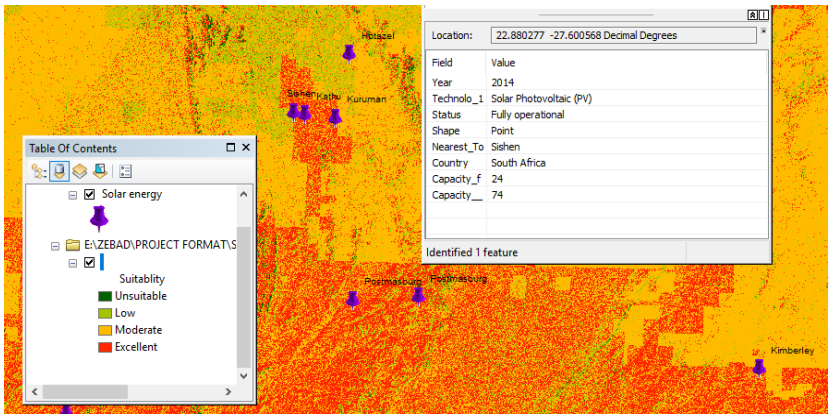

Figure 6 Map showing suitable area for solar energy in South Africa

The other aspect that needed to be examined was weather and climate variability impacts on the potential annual energy production of selected renewable energy project sites (wind, solar and hydropower) to assess what if scenarios. As such the nexus between renewable energy and weather and climate variability and uncertainty can be predicted.

Hereafter, the data was uploaded on open GIS that envelopes solar, wind energy and climate information, so it can be downloaded to make investment decisions.

Figure 7 OpenGIS data access process

Furthermore, the results are expected to be incorporated with numerical weather predictions and climate features for short term and long term impact assessment on investment and variability of energy production by simulating what if scenarios on the selected sites.

4. FELLOWSHIP CONTRIBUTIONS

4.1.Data Collection

I have been collecting socio-economic data to be used to assess the energy production variance that occur due to climate and weather variability. Data such as:

- Supply of electricity (by source, thermal generation and renewable - disaggregated, e.g. wind, solar).
- Production capacity of electricity (by source, thermal generation and renewable -disaggregated, e.g. wind, solar).
- Energy investment
- Load factor
- Total energy demand
- Total energy demand (by sector: residential, commercial, industrial, transport)
- Energy prices and costs
- Primary energy supply
- Employment

4.2.Workshop Organization

I participated on organizing the WISER Workshop on Socio-Economic benefits of climate information services which was held in Addis Ababa, (Feb 06 – Feb 11 , 2017) at UNECA.

4.3.Others

- Serving as rapporteur during the WISER workshop on Socio-Economic benefits of climate information services

- Participating in meetings at ACPC

4.4.Missions Traveled

February 20 - March 07/2017 to Kenya, do data mining on Africa renewable energy resources and work with Regional mapping center for research development (RCMRD) based in Nairobi to further elaborate the GIS output of the mapping exercise and develop jointly done materials and frameworks for the capacity development aspect.

5. FELLOWSHIP BENEFITS

This fellowship benefited me, but not limited, to enhance my level of understanding on:

(i) evaluation and interpretation of social and economic data;
(ii) the linkage between renewable energy, weather and climate
(iii) assessment of the energy dimension of the socio-economic benefits of climate information services
(iv) Impacts of weather and climate variability and uncertainty on annual energy production of renewable energy.
(v) the process of planning workshops like socio economic benefits WISER
(vi) working collaboratively with multicultural colleagues

Overall, this fellowship gave me an opportunity to broaden my knowledge on energy and climate information and the role it has on climate change on a global scale.

6. CHALLENGES

There was shortage of time for the work scope, hence specific study sites were left out for further study. Shortage of time for data mining cost the opportunity to gain an in-depth understanding of renewable energy and climate information. Data that can be used as criteria for determining the suitability of renewable energy sites were left out due to limited timeframe. ArcGIS software also contributed its share of time consumption by taking long time to process the raw data.

7. THE WAY FORWARD

7.1. Fellowship

The fellowship programme is a very beneficial for capacity building in Africa on energy and climate information services aspect. In the future the fellow can benefit if the time frame is extended for an in-depth research on different energy resources and climate information services. Furthermore, placing fellows to collaborate with other institutions and get training on different computer programs that are linked to energy and climate information will be very beneficiary. In addition by giving fellows chances to participate and present on an international workshops and conferences, by creating platforms where they can exchange ideas with other fellows on climate and energy related topics from other organizations. Moreover, would be recommended if the fellow can do site visitations for selected renewable energy sites for getting primary and updated data on both climate information and energy.

As we move forward, there should be a signed agreement between ACPC and partner institutions where the fellow is placed for training to gain the utmost benefit.

8. ACKNOWLEDGMENT

I would like to give my acknowledgment to the Africa Climate Policy Center for giving me a chance to enroll in this fellowship program. I would like to thank Dr. Linus Mofor for his most valued inputs and his mentorship. I would like to also acknowledge Dr. Joseph Instiful and Dr. Yoseph Amha for their guidance and support. I am also grateful to RCMRD for giving me a chance to work with them. I would like to thank Mr. Byron Anangwe and Ms.Rose Waswaand for their continuous support during my stay in Nairobi. I am also deeply indebted to all ACPC staffs' that made my stay in the center a memorable one.

9. RESUME

Zebad Alemayehu Mekuria holds a MSc in Land management and Land tenure in 2016 from Technical University of Munich (Germany), an MSc in Environmental planning and Landscape design in 2014 from Addis Ababa University (Ethiopia) and a BSc in Urban and Regional planning from Addis Ababa University (Ethiopia). She has worked as Environmental planner and resource manager at Esna and Associate Consulting Plc,(Ethiopia). She has organized Global Geospatial Conference 2013, Third Annual Climate Change and Development; she has also organized a workshop that was hosted by Technical University of Munich (TUM) in Johannesburg, South Africa, 2015. She has worked on the project, "Transformation to sustainability", funded by the International Social Science Council (ISSC) involving forest areas in Indonesia. She has Co-organized a knowledge network spanning researchers and organizations from Africa, Asia and North America as well as Co-researched, prepared and presenting a paper. She had made a contribution and presented on the 16th annual World Bank 'Land and poverty Conference' titling "Cemeteries on climate smart Land use which was held at Washington D.C, USA. She has a peer reviewed paper on "Participatory rapid co-design for transformative resource governance research the Gulf of Guinean". Since January 2017, she has become an energy and climate information services fellow at ACPC.