

Interactive comment on “A Water-Energy-Food Nexus Approach for Conducting Trade-off Analysis: Morocco’s Phosphate Industry in the Khouribga Region” by Sang-Hyun Lee et al.

Anonymous Referee #2

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Summary

In this paper, the author emphasized a unique type of nexus that can help us to have a clear idea about the importance of Phosphate production in Morocco and its impact on water and energy use and agricultural production. The author imported the WEF tool and applied it to the WEF-P case study. The results seem to be promising if the nexus Phosphate doesn't exist. Otherwise, the WEF tool is more efficient in the calculation of water and energy demand and carbon emission, but in the case of the phosphate, it is quite critical since there is a need to calculate the environmental risks caused by the phosphate production on water resources and crop production. Moreover, phosphate

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production didn't impact only the water and energy footprint and CO₂ emission but it can destroy the agricultural land (phosphogypsum, radioactive wastewater), affect air quality (dust) and human health (phosphate rock has been reported to possess toxicity to varying degrees, and Be, As, Cd, Hg, Tl, and Ra are generally designated as extremely toxic). All this has led me to have some interrogations:

1- The author didn't give a clear idea about the water footprint and energy footprint and how they contribute in the assessment scenarios, did they matter when it comes to producing a clean food? And concerning the Carbon footprint, is the Carbon show a real danger in front of all the radioactive components of phosphate?

2- The author applied the tool considering the phosphate as a simple nexus component like water or energy. Otherwise, there is a need to emphasize all environmental and economic aspects related to this product and the interaction between agricultural and phosphate production in the study area, to consider that this tool is efficient and can be considered as the best decision-making tool when it comes to this type of nexus.

3- The paper is not well structured, there is a gap between different sections in the paper. The author didn't explain the choice of the scenarios and the methodology of data collection.

4- In the discussion part, no scientific comparison, even if the tool developed by the author, it is important to compare the findings, especially in the WEF nexus impact on water and energy footprint and CO₂ emission.

Specific comments

1- The introduction is too general and missing a good literature review. The author didn't talk about the novelty of the use of the WEF-P tool and the difference between it and the WEF tool (<http://www.wefnexus.org>). There is also a need to emphasize the pros and cons of the used tool, especially that phosphate production has a very interesting economic value but a very bad environmental impact, and here comes the

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importance of the concept of the sustainability index existing in the WEF tool 2.0.

2- Line 65: it is better to use the actual information as 2019 for the population growth and avoid using hyperlinks in the text as reference the same in the lines 68 and 70

3- Line 76 to 80: the author needs to add a reference for the quote

4- Part 2.1: from where came the differentiation of the different types of water and from which background the new water concept is coming? and is the wastewater used is coming from phosphate washing? If yes, are you sure that it is safe?

5- Figure 1: the description of the figure is missing. Otherwise, there are two missing key concepts need to be considered: sustainability index and environmental index (related mainly with the Phosphate toxicity)

6- In the site description: it will be good to have a general idea of the study area (location, climatic conditions: rainfall, temperature, wind, radiation, water resources, soil resources, agricultural activity, energy source) since the author involved the evapotranspiration calculation and water and energy footprints.

7- Part 2.2.2 the author underlined mainly the different steps of phosphate production and missed a good explanation of the footprint calculation and the data gathering methodology and date frame of the collected data. For the CO₂ emission, the author linked it only with energy use, but he forgot to mention the importance of having a healthy soil can play a crucial role in carbon sequestration.

8- Part 2.3: the author used the ETP requirement to calculate the irrigation water requirement which needs to be revised and does the used data in this calculation are reflecting the exact situation of the study area?

9- Table 1: do you mean by plan data the plantation season or the date of data collection?

10- For the results and discussion, the choice of the scenarios should be clarified

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before

11- Figure 3: it will be better if you consider the ETP to extract good information

12- Line 64: (Taleb 2006) a comma is missing

13- Line 74: (OCP 2013) a comma is missing

14- Figures from 1 to 6: add short descriptions

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