Bibliometric analysis of renewable energy resources in the context of extreme weather event: Case megadroughts

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INTRODUCTION

The decarbonization of the energy sector is vital to mitigating climate change, and it is driven by global initiatives such as IRENA's REmap roadmap, which evaluates renewable energy expansion potential [1]. In Chile, reliance on hydropower faces challenges due to recurring droughts, worsened by climate phenomena like the "megadrought" since 2010 [2]. This underscores the need for energy matrix diversification with solar and wind resources. Through a bibliometric analysis (2005–2024), this study explores global research trends on renewable energy integration, highlighting strategies to mitigate climate change impacts and support sustainable development.

METHODOLOGY

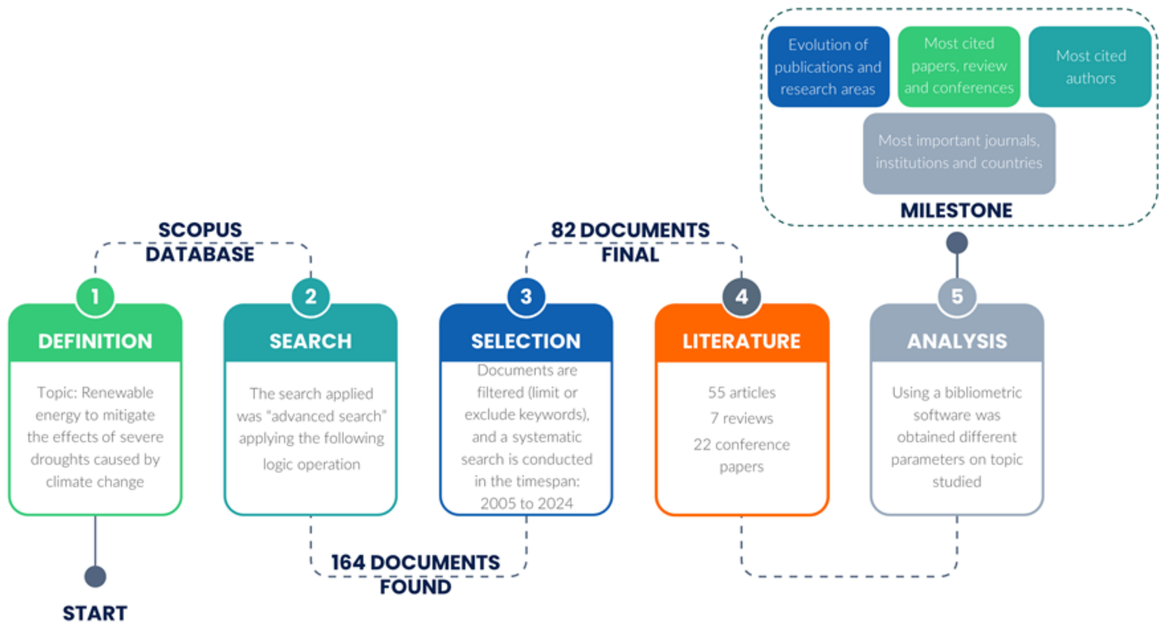

Fig. 1 - Working methodology for literature search and bibliometric analysis.

RESULTS

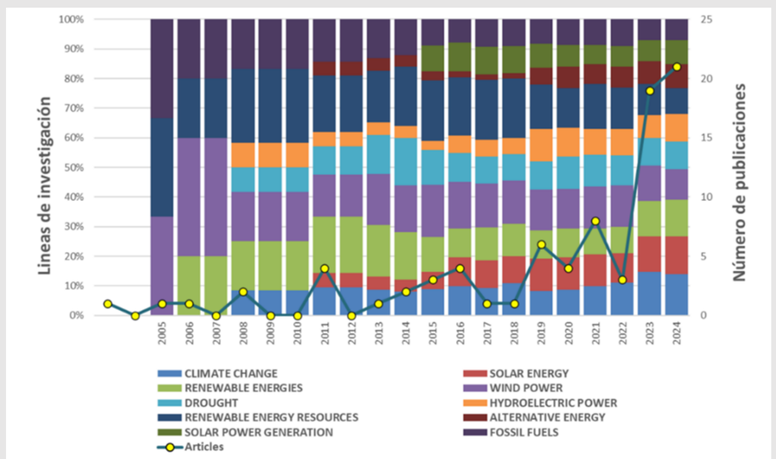

Fig. 2 - Evolution of the number of publications in the target field over the years (2005-2024). Most used keywords in the research field.

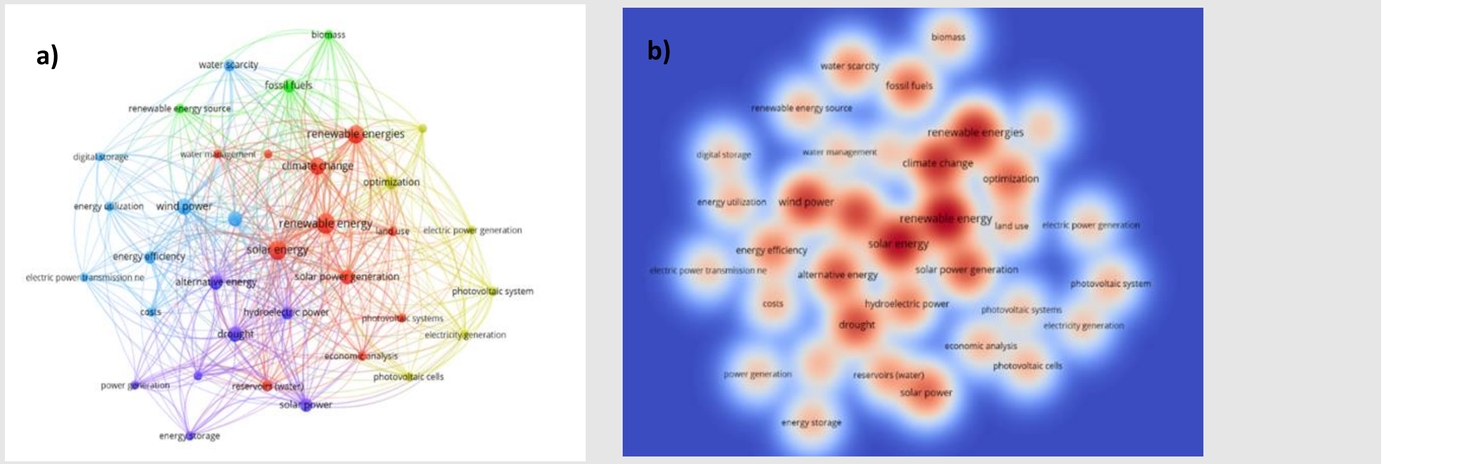

Fig. 3 - Clustering of the 35 most frequent keywords of the authors in the target field a) Map of terms based on different clusters; (b) Density visualization map.

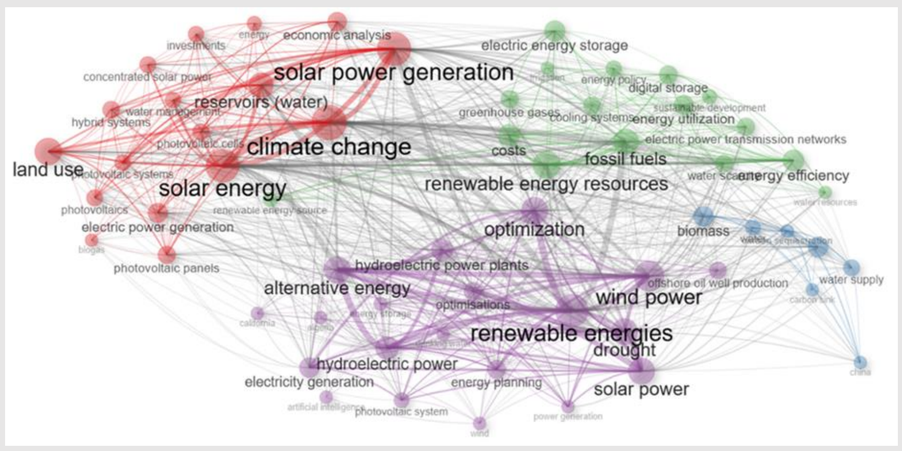

Fig. 4 - Clusters on the most frequent keywords.

Table 1 - Cluster of keywords obtained using Bibliometrix software.

Clustér	*Palabras claves principales*	*Número de Palabras*	*Palabras claves en la red Bibliometrix*
1	Renewable energies	19	renewable energies, wind power, drought, hydroelectric power, alternative energy, optimization, solar power, energy storage, hydroelectric power plant, selectricity generation, energy planning, power generation, drinking water, offshore oil well production, optimisations, photovoltaic system, wind, artificial intelligence, california.
2	Solar energy	17	climate change, solar energy, solar power generation, land user, eservoirs (water), economic analysis, photovoltaic cells, water management, electric power generation, energy, photovoltaic systems, concentrated solar power, hybrid systems, investments, photovoltaic panels, photovoltaics, biogas.
3	Renewable energy resources	16	renewable energy resources, fossil fuels, energy efficiency, water scarcity, costs, energy utilization, renewable energy source, digital storage, electric power transmission network, selectric energy storage, energy policy, greenhouse gases, irrigation, sustainable development, water resources, cooling systems.
4	Biomass	5	carbon, biomass, water, water supply, china.

The bibliometric analysis showed an exponential increase in the scientific production of renewable energies over the last six years. The most studied areas include solar energy (26.83%), climate change (29.27%), and renewable energies in general (25.61%). The most relevant keywords were "renewable energy," "solar energy," and "wind energy," reflecting the focus on energy diversification and the search for solutions to water scarcity. China and the United States lead scientific output, with Stanford University and Nanjing University being among the top institutions.

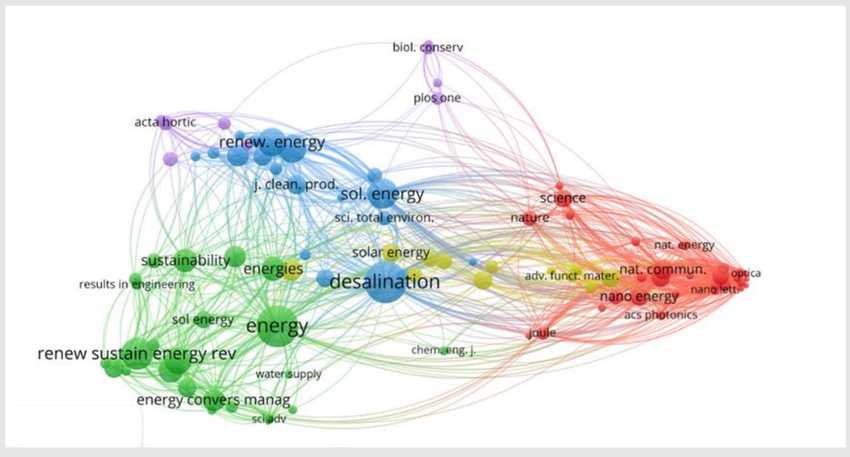

Fig. 5 - The most prominent magazines related to the topic..

CONCLUSIONS

Research on renewable energy and megadroughts has surged in recent years, peaking in 2023-2024, with a focus on climate change, solar energy, and water-independent technologies. International collaborations, particularly with China and the USA, drive progress, emphasizing hybrid solar-wind systems for mitigating water scarcity. Solar energy is pivotal for water-scarce regions like Chile, while rural access and emission reduction in high-consumption sectors highlight renewables' potential. The transition from fossil fuels is evident, requiring advancements in technology, global cooperation, and policy support to ensure resilience against climate extremes.

[1] M. Aria y C. Cuccurullo, “bibliometrix: An R-tool for comprehensive science mapping analysis”, J. Informetr., vol. 11, no 4, pp. 959–975, nov. 2017, doi: 10.1016/j.joi.2017.08.007.

[2] M. Oertel, F. J. Meza, y J. Gironás, “Observed trends and relationships between ENSO and standardized hydrometeorological drought indices in central Chile”, Hydrol. Process., vol. 34, no 2, pp. 159–174, 2020, doi: 10.1002/hyp.13596.