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KEY FIGURES :

- Over **400,000 grid cells** of 0.12 km² analyzed in Morocco
- Digital simulations covered 35 km of power lines and **2,000 substations** in Uzbekistan
- Climate risk projections from **2024 to 2038** integrated into the site evaluation process in Morocco.5

A digital solution to support site selection and resilience of advance small modular reactors installation

Khwansiri NINPAN1,* , Tejas Jayram BHOR1 , Olivier VINCENT1 , Jean-Francois BOSSU1 , Mohamad Ali ASSAAD1 , Lies BENMILOUD BECHET1

[1] Digital Excellence Center, Assystem, Courbevoie, France

* Correspondence : knînpan@assystem.com

INTRODUCTION

Advanced and Small Modular Reactors (AMRs and SMRs) is expected to substantially enhance the role of nuclear energy in the global energy mix. Their successful deployment relies heavily on optimal site selection.

PROJECT SCOPE

The site selection process requires careful consideration of various factors, including :

- **Site-specific factors**: AMRs/SMRs site selection requires careful evaluation of geological factors, water access, infrastructure, population, and environmental impact. Balancing these factors requires a thorough trade-off analysis.
- **Grid integration**: Ensuring seamless integration of AMRs/SMRs into existing electrical grids is crucial. A comprehensive study is needed to maintain grid stability and prevent disruptions.
- **Climate impact**: Long-term climate projection uncertainty analysis are essential for sustainable AMRs/SMRs siting, considering their extended lifespans.

This study presents innovative methods that integrate the essential aspects outlined above.

CONCLUSION

Our approach accelerates the development and deployment of AMRs and SMRs to meet the growing global energy demand. Through a holistic site selection process, the solution provides an innovative framework for sustainable energy management.

MULTI-CRITERIA DECISION MAKING

We used shapefiles to gather detailed geographic data for Morocco. Our platform allows users to define their site selection criteria, including features, feasibility margins, optimization objectives, and relative importance. This enables tailored and efficient site identification.

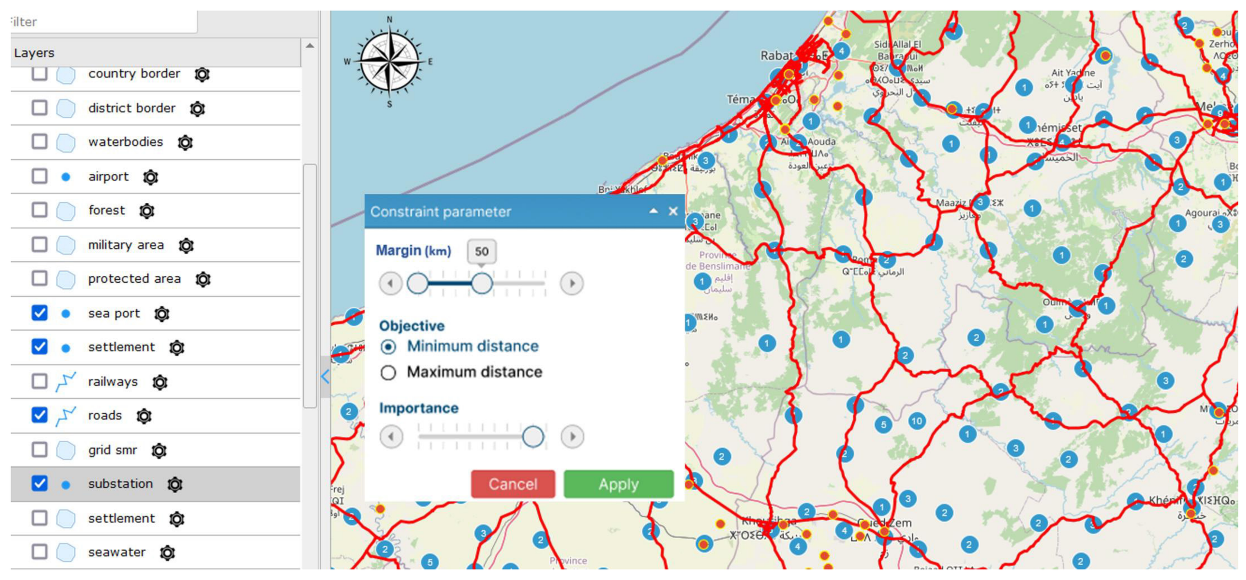

Fig 1. *The interactive interface showcasing the Morocco study area, overlaid with user-defined features.*

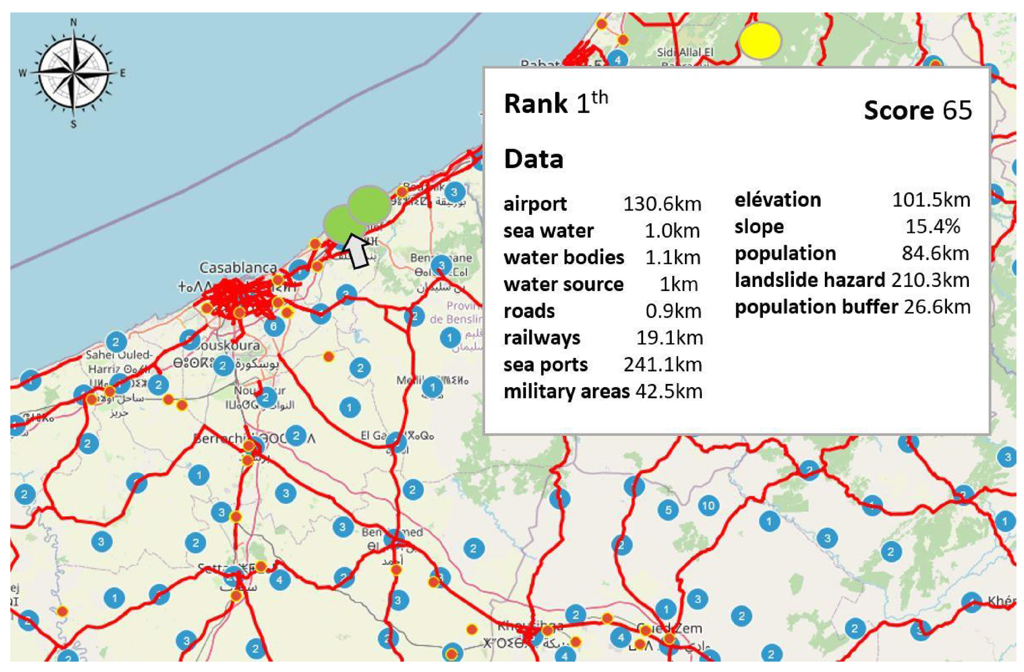

Fig 2. *Sample output from the site selection process after filtering and ranking. Hovering over the selected area reveals additional details, including its rank, overall score achieved, and other relevant geospatial features.*

ASSESSMENT OF GRID INTERACTION

The grid impact assessment was carried out in Uzbekistan. Digsilent PowerFactory and Python scripts were used to simulate grid behavior under various scenarios. Mitigative actions were implemented to ensure grid stability.

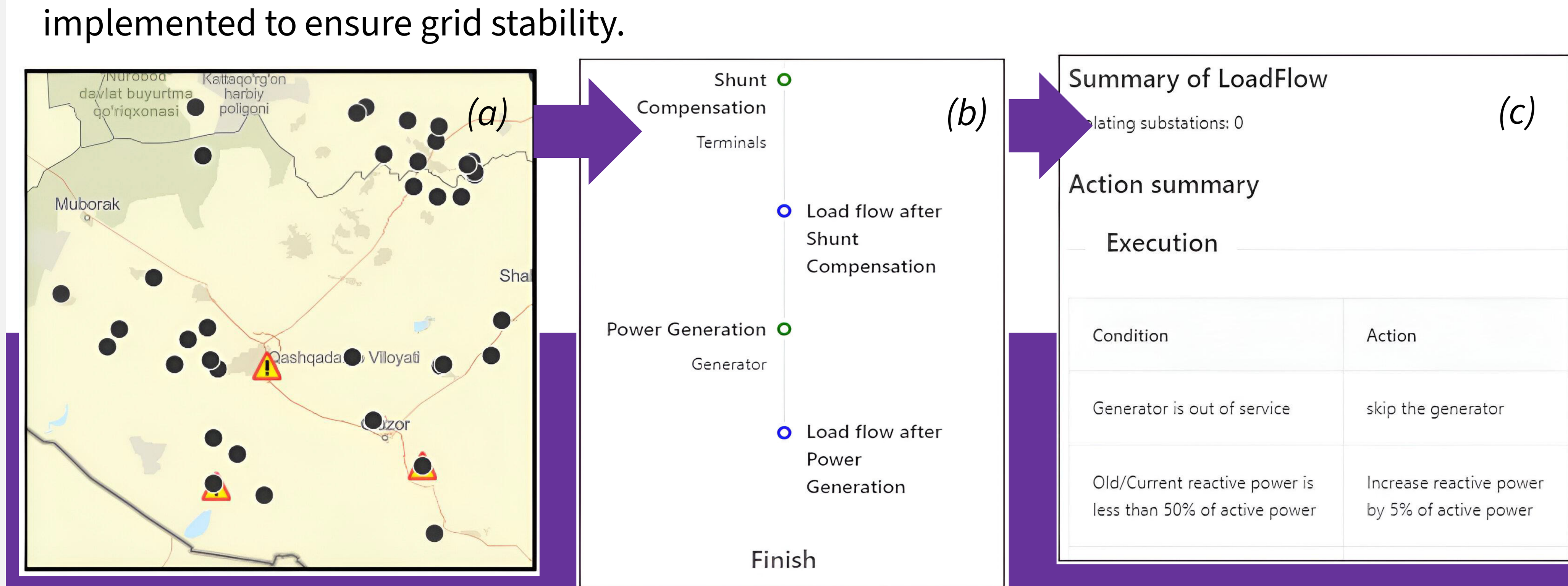

Fig 3. *(a) The application displays a region in Uzbekistan, where black markers represent existing electrical substations and overlapped warning signs indicate violations at specific substations. (b) A part of the mitigation action process. (c) The load flow summary results, providing details on the action and suggesting the necessary actions to be taken under specific conditions..*

CLIMATE CHANGE PROJECTIONS

The climate projection analysis encompassed three climate risks: air temperature, sea surface temperature, and sea level. The objective is to help clients account for long-term risks ensuring site resilience over the multi-decade lifespan of AMRs/SMRs.

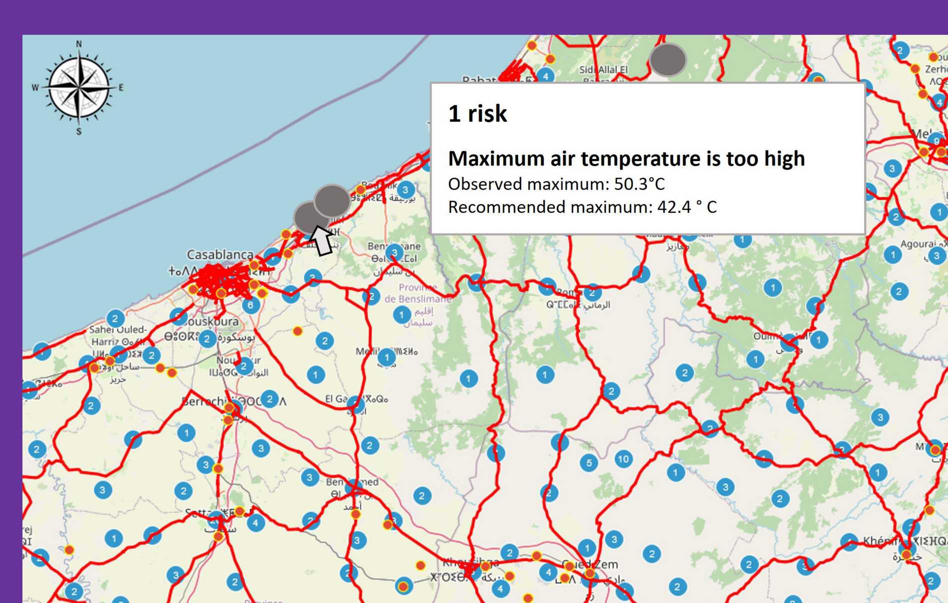

Fig 4. *Example of the climate projection analysis for the top-ranked grid cell identified in Fig. 2. The analysis reveals that this grid cell faces one risk related to air temperature.*