Report

IT 300

Business Intelligence and Database Management Systems

Business Intelligence Mini-Project
SunWise Analytics

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Submitted to:

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1. Key Findings:

- **Regional Solar Potential Across MENA:**
    - The analysis shows that North African countries such as **Libya** and **Algeria** exhibit the highest adjusted solar irradiance, driven by strong natural solar exposure. **Tunisia** and **Morocco** follow closely, while **Egypt** shows slightly lower irradiance but compensates with stronger grid availability and population proximity

      => High solar irradiance directly translate into high energy output per square meter, improving project profitability and reducing LCOE. Regions with strong solar indices are therefore prime candidates for large-scale solar investment.

- **Seasonal Variability of Solar Irradiance:**
    - Solar irradiance in **Tunisia** and neighboring regions peaks during spring and summer, while winter months experience a noticeable decline.

      => Understanding seasonality is critical for decision-making. Investors and operators can better anticipate fluctuations in output and design systems that remain financially viable year-round.

- **Energy Output Potential per Square Meter**
    - Regions with higher adjusted GHI also show significantly higher potential energy output per square meter. **Libya** and **Algeria** rank highest, while Tunisia and Morocco offer balanced performance with fewer extreme conditions.

      => Energy density is a key driver of land-use efficiency. Higher output per square meter reduces land requirements and installation costs, making projects more attractive in regions where land availability or cost is a constraint.

- **Grid Availability and Feasibility**

- Regions with stronger grid infrastructure, such as **Tunisia** and **Egypt**, score higher on feasibility despite slightly lower solar indices compared to desert regions.

  => Grid readiness can be a decisive factor in project success. Strong solar potential without grid access increases capital costs and delays deployment.

2. Business Recommendations:

Prioritize High-Irradiance Regions for Utility-Scale Projects:
Focus large-scale solar farms in Libya and Algeria where solar potential and energy density are highest.

Leverage Tunisia and Egypt for Faster Market Deployment:
These regions offer a strong balance between solar potential, grid availability, and population proximity, reducing operational and transmission risks.

Incorporate Seasonal Planning into Financial Models:
Revenue forecasts should explicitly account for seasonal variability to improve financial accuracy and investor confidence.

Mitigate Efficiency Losses in Desert Regions:
Invest in panel cleaning strategies, heat-resistant technologies, and maintenance planning to reduce downtime and efficiency degradation.

Use Incentive Schemes to Improve Project Profitability:
Feed-in tariffs and tax incentives significantly improve revenue and shorten payback periods, particularly in emerging markets.

Integrate Grid Infrastructure Assessment Early
Grid availability should be evaluated alongside solar potential during site selection to avoid costly delays and infrastructure investments.

Highlight Environmental Benefits in Stakeholder Communication
Emphasize CO_2 emissions avoided to attract green financing, public support, and international partnerships.

3. Limitations & Future Improvements:

- **Limitations of the analysis:**
    - **Data Representativeness:** The dataset is based on Tunisian measurements and scaled to MENA regions using indices, which may not fully capture local conditions.
    - **Proxy Variables:** Dust storms and downtime risks were estimated using weather proxies rather than direct dust measurements.
    - **Simplified Cost Assumptions:** Installation costs, electricity prices, and incentive impacts were assumed constant across regions.
    - **Static Indices:** Solar, grid, and population indices are simplified representations and may change over time.

- **Future Improvements:**
    - Integrate **country-specific solar and weather datasets** for more accurate regional analysis.
    - Include **real grid capacity and transmission data** to improve feasibility assessment.
    - Refine economic models by incorporating **regional cost structures and policy variations**.
    - Add **long-term climate variability and climate change scenarios**.
    - Validate results with **industry benchmarks and real project data**.

4. Conclusion:

This project shows where and when solar energy performs best in Tunisia and the MENA region, helping identify strong locations for investment.

Using business intelligence indicators such as energy potential, payback period, LCOE, and CO_2 emissions avoided, this project shows: where solar projects make the most sense and why. The analysis helps compare regions, highlight the most cost-effective locations, and estimate how quickly investments can be recovered. These results give investors and decision-makers a practical basis for choosing suitable sites, prioritizing regions, and evaluating the financial and environmental benefits of solar projects.

*However, it is important to note that the dataset used is not fully representative of all MENA countries. While regional scaling factors were applied, real-world implementation would require validation using localized and official data sources to ensure accuracy. Overall, this project demonstrates the value of business intelligence tools in supporting strategic renewable energy decisions in the region.