Global Market Assessment of Small Wind Turbines for Rural Development

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Introduction

At present small wind projects are proposed and funded in a piecemeal fashion, this project aims to establish a methodology for global market assessments and highlight which regions in particular are suitable for the implementation of small wind. The market assessment not only identifies which countries are favourable, but also the reasons for their favourability. This information can be used to direct capacity building or advocacy efforts in order to increase the suitability of a given country.

Initially the project involved identifying which factors contribute to the success of small wind projects. Once these were identified, the working group worked towards assessing how well each qualifying country satisfies demonstrates these factors.

This project has been carried out by the Market Assessment Working Group, with members from the Universities of Strathclyde and Loughborough, and I Love Windpower.

Methodology

- Countries with high income levels, high electrification rates or low average wind-speeds disqualified from consideration.
- Factors (or 'Indicators') for successful projects identified.
- Data sources for all indicators collected.
- Each indicator scored from 0-3 for every country based on strict criteria developed by the group.
- Relative importance of indicators captured with weighting system as shown below.

Category	Category Weight	Sub Category	Subcategory Weight	Indicator	Fractional Weight	Cumulative Weight (%)
Physical	0.5	Environment	0.105	Corrosion	0.327	1.719
				Lightning	0.408	2.148
				Storms	0.265	1.396
		Terrain	0.211	Topography	0.500	5.263
				Land Cover	0.500	5.263
		Solar	0.158	Solar Magnitude	0.444	3.509
				Complimentarity	0.556	4.386
		Wind	0.526	Area	0.151	3.969
				Avg Windspeed	0.559	14.702
				Std	0.151	3.969
				Uncertainty	0.140	3.675
Human	0.25	Regulatory	0.286	RE Policy/Agency	0.291	2.078
				Rural Electrification Policy/Agency	0.364	2.597
				Standards	0.055	0.390
				Corruption	0.073	0.519
				Govt Effectiveness	0.218	1.558
		Capacity	0.238	Installed Wind Capacity	0.158	0.940
				Tertiary Enrollment	0.526	3.133
				Value Added Manufacturing	0.316	1.880
		Security	0.476	Security	1.000	11.905
Demand	0.25	HDI	0.263	HDI	1.000	6.579
		Gini Coefficient	0.211	Gini Coefficient	1.000	5.263
		Electrification	0.263	Electrification	1.000	6.579
		Rural Population	0.263	Rural Population	1.000	6.579

Results

The main result of this project is the generation of a list of countries most favourable for the implementation of small wind turbines, based on a wide range of factors. Below is the bar graph produced for the country scores, with breakdown by category. Island nations are omitted here, as it was decided that due to unique conditions found on most islands a separate assessment is required to consider island nations.

Breakdown of Scores by Category
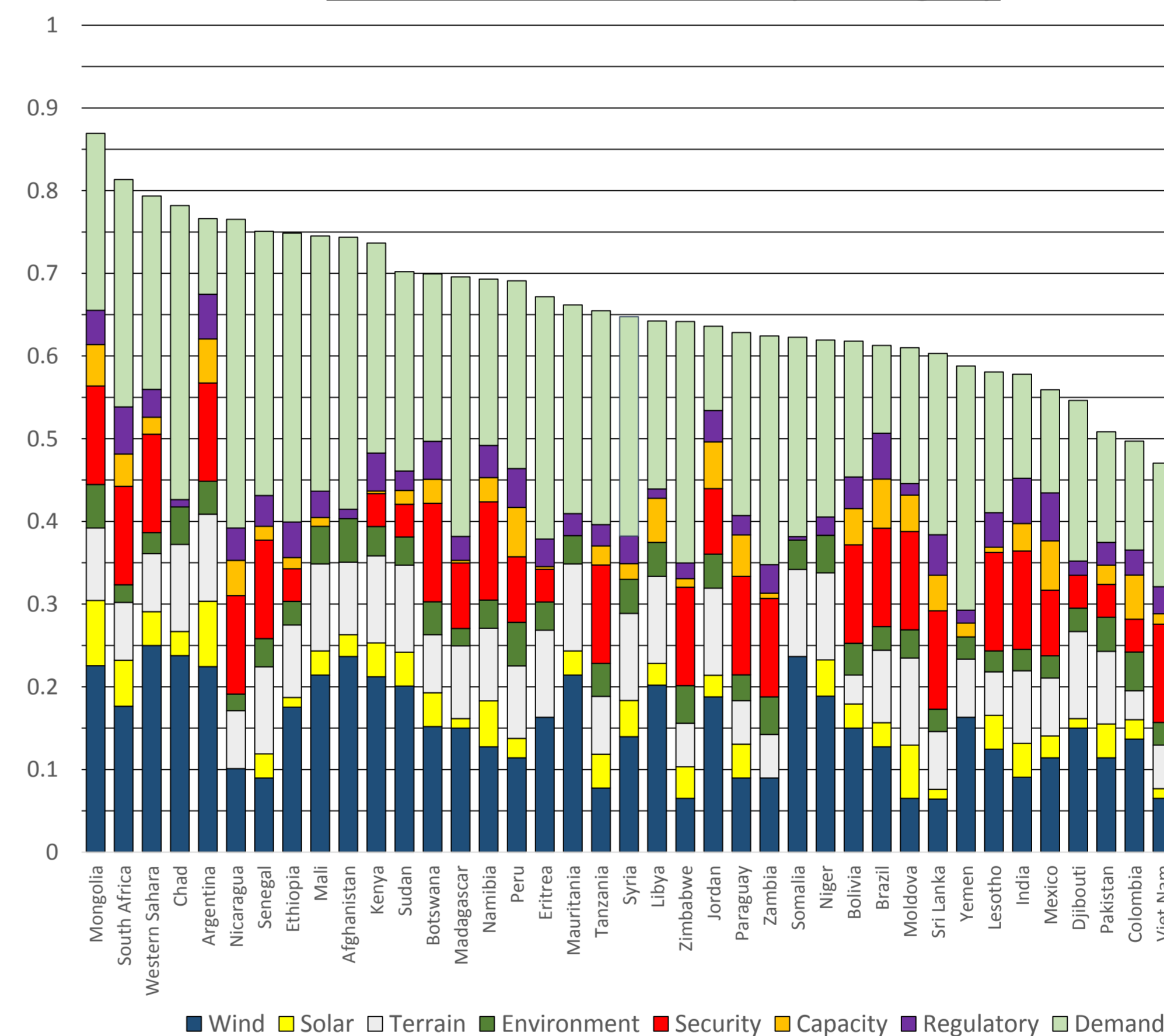
Conclusion & Evaluation

During this project it was found that for some countries a given indicator may lack data, for the sake of internal consistency it is necessary that where appropriate only one data set is used to determine scores. The average values for all countries was calculated and entered in place of the missing value. This lends an unwanted bias towards the centre of the range but remains the most appropriate solution for this study.

Perhaps the most challenging part of the study was in deciding upon the indicator weights, as comparing between different abstract concepts and how desirable a certain score would be. Clearly this is also the most subjective aspect of the study, and requires further sensitivity analysis in order for the results to be validated.

The study has succeeded in producing a list of most desirable countries for the establishment of small wind turbines for rural electrification, and in producing an intuitive methodology used to achieve this end.

Future Work

In order to better deal with absences of data, in the future a linear regression technique will be used to find correlations between indicators and extrapolate a 'best guess' value to input in the case of missing values.

During my PhD the methodology used here will be further refined, with the methodology made as robust and objective as possible through the use of GIS software and re-evaluation of certain factors. More detail will be used when evaluating indicators, population size will also be taken into account in order to pinpoint the countries where small wind can make the most difference to the largest numbers of individuals. Delivery models based on the findings of these assessments will also be developed, and installation projects implemented to gain feedback for the model.