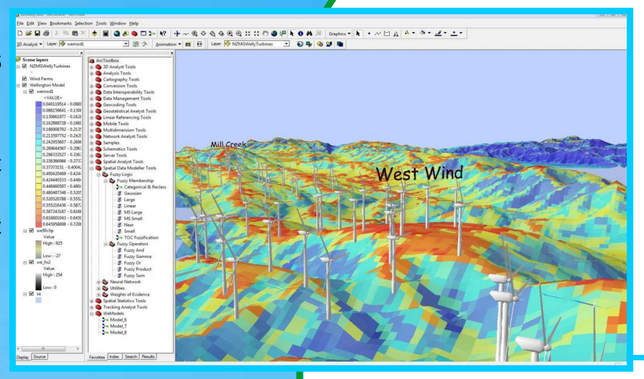
WIND FARM PROSPECTING USING GIS

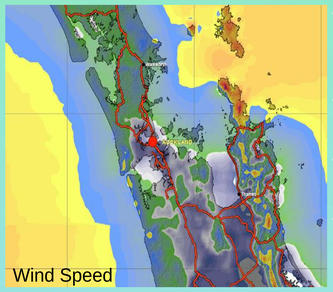
Kenex and Aurecon use advanced spatial modelling techniques to find locations ideal for new wind farms. Maps of the critical elements required for wind farm development are created and then combined using multi-variable modelling techniques. This produces a predictive map that at a national-scale targets new wind farm areas or at a local-scale defines wind farm extents and can be a guide for turbine placement.

- Wind speed, detailed terrain analysis, infrastructure, environment, land use and population details are incorporated into a single predictive map that ensures the most suitable wind farm sites are selected for development first, eliminating wasted time, money and effort.
- We have modelled at three scales: across an entire country for locating suitable wind farm areas, in local regions for more detailed mapping of wind farm extent, or at the wind-farm scale for turbine placement.
- Wind speed and direction data is generated from simulation of weather events using advanced mesoscale modelling technology.
- Our modelling techniques have been developed in New Zealand, one of the world's most challenging wind energy environments, are currently being used for exploration by Genesis Energy, and can be applied anywhere in the world for locating new wind farm sites.



MESOSCALE MODELLING

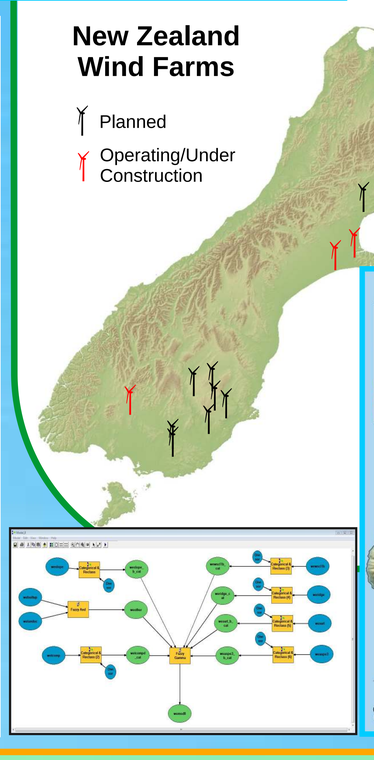
Quality wind speed data is a requirement in any wind farm modelling project. Continuous detailed coverage of wind speed and wind direction for our predictive model is provided by Aurecon :

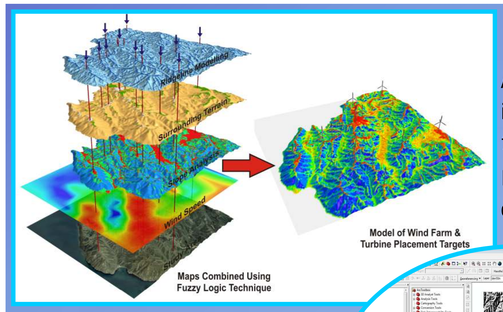


- Synoptic weather data is created by a global weather model incorporating thousands of land-based, sea-based and satellite observations.
- Downscaled synoptic data is used to predict surface conditions and generate hourly wind speed and direction data at a range of heights.
- The wind speed and direction data is analysed and classified into ranges suitable for different classes of modern turbines
- Variance of less than 5% from actual wind mast readings is achieved and superior spatial assessment of a site is possible with long-term wind trends also assessed.

BENEFITS OF SPATIAL DATA MODELLING:

- It allows us to combine spatial data and knowledge in a transparent, user friendly way.
- Multiple targets of possible wind farm sites are created that can be ranked and prioritised.
- Developers can easily define the extent of an individual wind farm.
- It allows for easy approximation of the number of turbines that the wind farm can hold.
- Land owners that need to be approached can be identified from the modelling results.
- We can manage and make sense of overwhelming amounts of spatial data that is collected during the development of a wind farm.



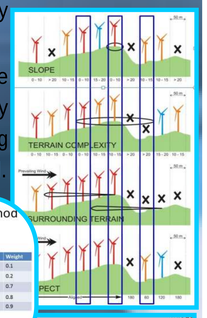


SPATIAL MODELLING

Advanced terrain modelling techniques have been developed using DEM data to determine ideal locations of slope, aspect to the main wind direction, complexity of surrounding terrain, ridgelines and upwind terrain effects.

Maps of these five terrain parameters are created using ArcGIS modelling tools and a customised toolbox created by Kenex. Each map represents a key element in the positioning of a wind turbine.

The requirements for these terrain parameters have been determined using expert industry knowledge from Aurecon and by studying existing wind farms in detail.

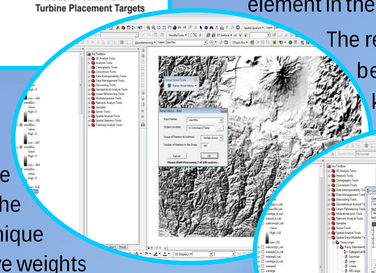


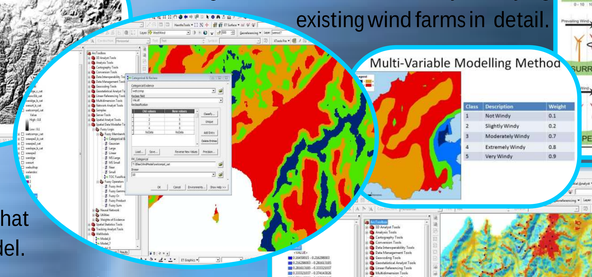
FUZZY LOGIC METHOD

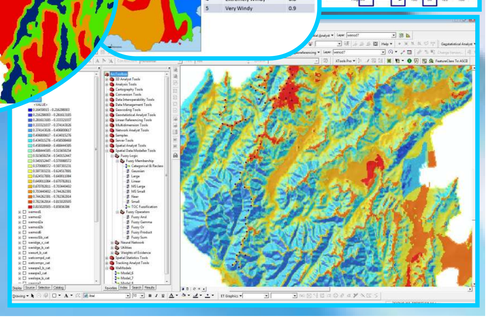
We use the fuzzy logic method in the ArcSDM toolbox to combine the relevant spatial data. This technique relies on expert knowledge to derive weights that rank the relative importance of the variables in the model.

Each dataset is weighted using a fuzzy membership function that expresses the degree of importance of the map layer in the model.

Predictive maps are combined in the Model Builder environment using a combination of fuzzy operators (fuzzy AND & fuzzy GAMMA). The output from the fuzzy logic model is a map showing feature favourability after combining the effects of all the input spatial data.



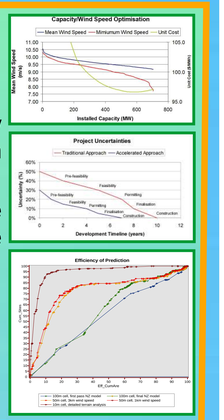




VALUE INNOVATION IN WIND DEVELOPMENT

Developing a successful wind project involves cost effectively confirming the project is feasible and addressing key uncertainties in wind farm capacity, energy output, and project costs.

Our modelling techniques deliver value innovation by reducing these key uncertainties from the start of the project and shortening the overall development time frame.



The outcomes for our clients include:

- Holistic assessment of a region or country that allows ranking of prospects and resource planning
- Competitive advantage in securing land rights and available grid capacity
- Improved effectiveness of development spending and superior return on investment.

Our wind prospecting tools have been implemented by Genesis Energy to evaluate turbine locations at their exiting projects including Castle Hill and to find potential new sites to develop wind farms in New Zealand.

Kenex
Creating opportunities in the spatial world

aurecon

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