Meteorological Considerations in Energy and Livelihood from Strange Attractors of Wind

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Abstract:

When renewable energy is considered as an energy source of choice in a post-growth society, then its technical and social implications must be resolved conceptually in order to bring its transition to a more motivated populace democratically and naturally. Wind and solar have high intermittency and they currently face obstacles in the current energy paradigms. These variable renewable energy (VRE) sources are vast enough by estimates to provide all of the energy that society could feasibly need for quite some time. But their transition into the dominant form of use has significant barriers to overcome.

Proposed solutions thus far have been to minimize the impact of renewables on the grid compliance through storage or demand side management. Both are highly referenced in literature and have a promising rate of progress. However, both solutions face a chicken or the egg issue when transition is considered practically. Renewables may be non-complicit and economically troublesome in this energy paradigm, but these proposed solutions require that such imbalances of intermittent renewables already exist in order to gain their own economic viability and stable rates for development.

Another lesser-known technique would be renewable energy complementary matching. This involves establishing new renewable energy sites that balance one another on a statistically reliable degree at nearly all time scales pertinent to energy transmission. Traditionally, this requires highly advanced knowledge of fluid mechanics, and climatological/meteorological forecasting. However, these models have failed to succeed because of deterministic chaos and its impact on the weather systems. By considering more strictly their time-dependent vs. oscillating forcing, chaotic determinant structures emerge. Long-term wind records show spatially and temporally related strange attractors from a network of 35 meteorological sites in Germany. The method for developing these mappings and wind path diagrams are determined from wind speed and wind directions that were used for a 2D Vector-Addition Mapping (VAM) method. These findings show a breakthrough in intermittency characterization that can further be transferred to rapid development of the complementary strategy.

The evidence shows that cities are remarkably interconnected in a very short temporal and spatial manner and poses a new idea of wind channel developments over time that are uniquely characterized and shared within regions.

Energy calculations of these chaotic strange attractors show certain location ratios can be depended on for normalized meteorological occurrences. Furthermore, they have impacts on agriculture and human livelihood as well. This study suggests that with a more fundamental understanding of natural resources means that natural resources can be harnessed in other ways. For example, energy calculations of the attractors also show an effect a large number of wind turbines will have in

dampening wind speed downwind of the turbines' wake. This brings implications that wind turbine can serve a dual purpose in breaking the wind to reduce effects of wind chill and forest damage, and energy generation.

Additionally, an artificial neural network was developed to demonstrate evidence of meteorological predictive strength of solar irradiation from wind data. These combined approaches have enormous potential in natural resource quantification on a very robust multi-temporal scale level and leads to a wide range of applicability and implications for agriculture and leisure. These advances in forecast methodology will grow increasingly important in a de-commodified world where natural resources are seen as the ultimate additive quantities to consider in a post-growth society. Furthermore, this informational package of dataset has a fairly low spatial resolution. Replication of these calculations over Delaunay Triangles or Voronoi cells can present far greater degree of accuracy and room for scientific tinkering. What is more important is that this methodology demonstrates how simple application of science can lead to an informational market of natural resources that can be quite creative, competitive and highly efficiency-inducing without any need manufacturing or sales.