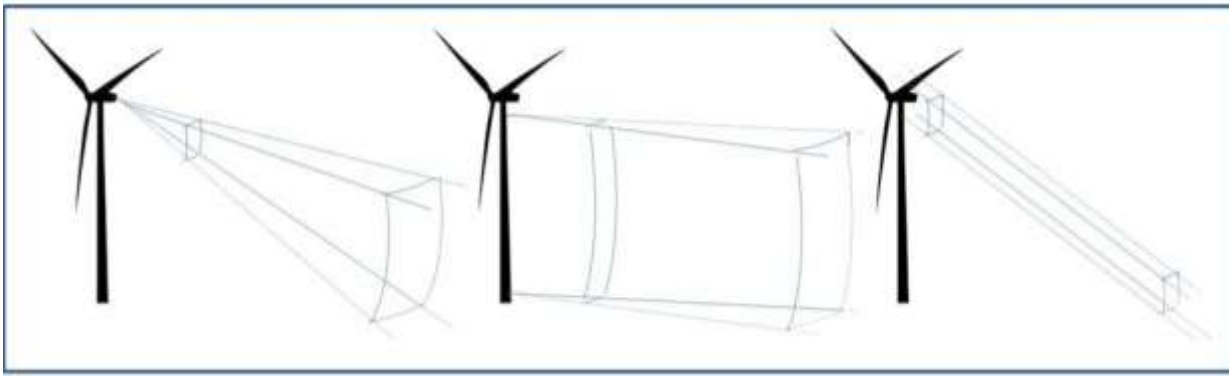
Outline Study Proposal - Wind Turbine EM Field Detection and Analysis



Current Status

Negative (and positive) ***biological*** effects of electro-magnetic (EM) fields are extensively described in the scientific literature[1].

Other studies of varying quality investigate the reported impact of wind turbines on humans living near them, "Wind Turbine Syndrome". These studies carry conclusions varying from "substantial negative impact" to " no statistically relevant effect", where potential causes investigated include noise, light fluctuations, motion awareness yet rarely EM fields; as EM fields are not covered these results are not relevant to the study proposed here.

Related research has been done on high voltage power lines, with most (epidemiological) studies indicating a long-term (negative) impact, as reasonably expected from the proven biological effects.

At the same time, an increasing number of "electro-sensitive" people is being identified worldwide, and some report a disturbing and occasionally debilitating effect from wind turbines at distances of up to several kilometres (alongside a range of other symptoms).

Question

What could be a reason that some people are able to "sense" wind turbine radiation at substantial distances of up to several kilometres, sometimes with debilitating effects, while accepted physics suggests that Electro-Magnetic (EM) field strength would diminish rapidly so as to render this unlikely?

Importance of the Question

In the context of the current low-carbon energy revolution, finding and then resolving potentially hazardous effects from energy generating equipment could prove to be economically, socially and environmentally highly relevant. Resolving potential issues early on is normally cost effective.

Subject of Study

Measurement and determination of sources and strengths of EM fields radiating from wind turbine installations.

Hypothesis:

While EM fields transmitted by wind turbines are typically assumed to decay with the 2nd power of distance (spherical, point source) certain circumstances could result in cylindrical fields (e.g. mast-cabling, decaying with 1st power of distance), while inadvertent wave-guide type structures (e.g. as part of the turbine construction) may even cause "non-decaying" EM fields to radiate over large distances (with small tangential coverage), further referred to as spot-beams.

Study Outline:

Simultaneous or near-simultaneous measurements of

1. **Sources of EM Fields**
   Potentially EMF-inducing voltage and current in situ at the turbine generator, including:
   1.1. intended voltages and currents,
   1.2. superimposed spikes ("dirty" power),
   1.3. secondary voltages in structures and equipment,
   1.4. other potential emitters as observed within the structure of the turbine housing, mast, blades and supporting installation (ground-based electrical installations, common-rail systems etc.).
   (This may already be subject of KalleHellberg's current work?)
2. **Point/Line Source Fields**
   Measurement of the full human-sensitive and commercially created (economically relevant) spectrum (e.g. 1 Hz through 5 GHz) of EMF at multiple distances and radial angles to determine:
   2.1. radiation frequencies and strengths sufficient to be linked to a potential cause,
   2.2. fall-off rates to confirm geometrical radiation model.
3. **Wave Guide Structures and Resulting Fields**
   Determination of potential wave-guide-like structures as part of the turbine including blades, mast and ground installation including cabling, transformers and housings.
   3.1. separately an estimation and measurement of the location where any resulting EM fieldsfrom these wave-guiding structures may be detectable,
   3.2. under which conditions these structures may show wave-guide characteristics (e.g. wind direction, humidity of structures, salinity of any ambient conductive deposits (ice, water).
4. **Non-Decaying Field Measurements**
   Measurement of EM fields at any relevant wave-guide target locations.
   4.1. Measurement at limited distance to wind turbine with drone-suspended measurement device, to confirm presence of EM fields at suspected wave-guide radiation sectors.
   4.2. Measurement of EM radiation at target locations (ground-level or existing structures) to confirm field decay rate (relative to drone-data) and determine field strength at potential human/animal exposure location.
5. **Secondary and Indirect Field Measurement**
   Qualitative or quantitative determination of secondary radiation from multiple turbine installations.Investigate EM fields either being induced in another turbine'sequipment or being reflected, causing the receptor turbine to emit an augmented level of EM radiation, or modified field target locations.

Background notes

Can people/animals detect EM radiation?

Biological and biochemical responsesof organisms to EM fields have been extensively documented[1], may occur with a lag and may have effects following exposure which last substantially longer than the exposure itself. With EM sensitive individualsthe perception of effects may be greatly differentamongst separate individuals. This variability should not be unexpected, since humans have not had an evolutionary need for EM field receptors within their nervous system: the ambient EM field strength has never been greater than approximately $10^{-11}$to $10^{-18}$of the current everyday ambient field strength[3], until around 1940when radar technology started to develop.

Study area selection.

There are likely relevant differences between types of wind turbine installations, and additionally coupled (clustered) turbine grids are likely to have different power, voltage and frequencymatching methods than single installationswith different associated EM field generating systems. This implies that the selection of study area may have an important impact on any outcomes.

Related benefits to understanding.

Many reports exist regarding negative impact on birds, bats and cattle from wind farms. Some animals are known to have EM sensors which they use e.g. for navigation. Understanding which EM fields are present near wind turbines and wind farms may allow designers to alleviate these issues.

Images

Model	Point source	Line source	Wave quide
Decline	**2nd order**	**1st order**	**None**
Detectability	**Omnipresent**	**Omnipresent**	**Spot-beam only**
Risk of exposure	**Declines quickly with distance**	**Declines moderately with distance**	**Location & orientation dependent**

References

1. *Bioinitiative Report, 2007, 2012 [http://www.bioinitiative.org/]{over 1000 studies included}*
2. *Martin Blank, PhD, "Overpowered", 2014, {over 400references}*
3. *Prof. Leif Salford, lecture: Electromagnetic Fields and Leakage of the Blood Brain Barrier [https://www.youtube.com/watch?v=E_WJ_aJPWIA]*