Researching the feasibility of stadium roof mounted turbines as a centralised district power network within the built environment

Context and Rationale

Background: Offshore and onshore wind farming can't offer a more sustainable renewable energy source than an alternative sufficient source of wind energy being generated innovatively for district power within the urban environment.

Major theme: *Poor Embodied Energy and Energy efficiencies lead to higher carbon emissions and higher costs currently being produced from existing offshore and onshore wind farming.*

Wind energy produced innovatively within the urban environment avoids high embodied energy occurring from existing wind farming carrying out; civils, geotechnical, and electrical distribution work needed to transmit electricity to end-users. Less embodied energy is utilised in distributing power to the end-user over a shorter distance, means less cost for wind energy generated within the urban environment. The further the power generation produced away from the end user, the more latent power will be lost due to the distribution of the electricity having to be transmitted to the end-user. Resulting in poorer efficiency of output used from an end-user using a source far away such as offshore wind power generation, as oppose to power being generated on the end-user's site or close proximity to the end –user. This inevitably leads to a more costly waste of power generation, irrespective of generating larger yields form larger turbines, at windier offshore or onshore greenbelt sites.

However, sufficient enough yield from a turbine generating power within an urban environment is needed to substantiate its investment in its specific location within an urban environment, to be able to compete indirectly with offshore and onshore greenbelt site wind farming for growing market share within the wind energy generation industry. This not only highlights the potential for better carbon reductions satisfying the BREEAM policy, due to lower embodied energy being used to produce and distribute innovative wind energy within the urban environment, but also highlights huge cost reductions, as well as improving environmental impact assessments to enable planning policies to fast track and accept more onshore wind energy developments. Indicating that renewable energy targets set by government could be met more realistically within the current time period, if innovative applications of urban wind energy production and distribution, are to be carried out. Buildings are currently rated on how sustainable they are through BREEAM assessments. If a building generates 100% of its own renewable energy source, as well as metering the majority of what it generates on the site of the building back to the national grid, then it will achieve the highest sustainable BREEAM rating for achieving innovation, rather than sourcing the wind energy from offshore or greenbelt sites. Indicating that innovative wind energy generated within the urban environment can become more attractive to investors based upon better; economics, environmental impact assessment, carbon reductions gained from less embodied energy, and BREEAM rating.

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Problem and why the topic is so important to investigate and arrive at most appropriate solution:

Currently large free standing turbines are being procured to be located within the built environment to generate renewable district power for nearby buildings. However, these turbines face challenges such as; high cost of capital, resulting in higher payback period for 2MW freestanding HAWT turbines within the built environment as oppose to the small scale roof mounted wind turbine array. A 2 MW free standing HAWT turbine when compared to a potential roof mounted turbine array within the urban environment has a poorer environmental impact assessment. It faces investment challenges such as; having a poor social acceptance due to being too obtrusive in the landscape, and a poor environmental impact due to affecting local ecology (e.g. bird sanctuaries), air traffic control interference and obstruction, and being proximity to nearby buildings affects their working environment due to its large shadow flicker. It also produces a lower efficiency of performance for wind energy being generated in comparison to roof mounted turbines (Which impacts on having a slower payback period).

The problem with achieving a poor EIA assessment, is that planning agreements rely heavily on the EIA assessment being good in order to allow planning for a project to go ahead. The results from MFC's EIA reflects that the project should not go ahead based on the EIA being poor regarding the social, environmental, and poor efficiency of energy performance stated further in this research.

The proposed roof mounted turbine application will hypothetically achieve a good EIA, resulting in the likelihood of planning being agreed, whilst fast tracking the programme of work.

It is important to investigate a way which is going increase the generation of urban wind power on a district level which will be more advantageous for investors and developers to achieve good EIA and return on investment. My proposed configuration of smaller scale array of turbines avoids the poor EIA and ROI, resulting in improving social and environmental acceptance, whilst also improving efficiency of performance of the turbines, resulting in quicker payback, and return on investment. Making it a much more marketable product to the wind energy industry, as it has a better Environmental Impact Assessment, and economic appraisal for investors and developers. The problem with the case for large free standing wind turbines generating renewable power within the urban landscape, is that they are:

- too capital intensive leading to high risk for borrowing in current economic recession;
- too long for payback on investment in current economic recession;
- too costly for importing manufactured large turbines from Europe at present, due to strength of sterling being weak. (Hence the case for roof mounted turbines is better, due to being manufactured in UK, and less capital intensive;

- procurement lead time is too long for large turbines, due to demand is outstripping supply for more priority usage of large turbines being supplied to offshore wind farms, and onshore green belt sites;

- higher probability of planning restrictions for large 2MW freestanding turbines being built and operating within the urban environment as well as on some greenbelt sites, due to poor environmental impact assessment (EIA). Resulting in time a lot of time wasted for the client waiting for the project to be told that the project cannot be permitted planning permission, (maximum 3 years), thus a lot of expense wasted for the client on commissioning consultants to produce the different required environmental impact assessment reports (which are very costly – in total approximately £95,000 for a 900 page report);

- longer programme of work, due to a longer period of planning process to be carried out, to adequately assess a specific site. (Resulting in a lot more money spent for the client on professional fees than roof mounted turbines, as roof mounted turbines avoid civils costs, geotechnical, and longer environmental assessments – due to having more of an impact on the environment);

- longer programme of work for planning and environmental impact assessment to be carried out presents a case for the feasibility of the large turbine being too complex, as oppose to the roof mounted turbines;

- overall a larger 2MW freestanding turbine generating renewable power within the urban environment will have a higher environmental impact, than roof mounted turbines, in comparison to an innovative configured array roof mounted to a stadium with similar annual wind energy yield;

- all that is needed regarding assessements with the innovative roof mounted configuration is a feasibility study- including techno economic assessment, supported with an environmental report (a 60 page document maximum rather than a 900 page EIA document)

    - Achieving at least a 2 year reduction in project delivery time and huge cost savings for clients by avoiding lengthy and costly commissioned EIA reports, which also means meeting climate change targets much quicker. .

    - Resulting in higher probability of projects coming to fruition, rather than wasted time and expense within the construction and energy industries.

    - Avoiding the fear of turbine manufacturers going into insolvency due to projects not coming to fruition because of negative EIA reports.

    - Avoiding higher cost of capital in currently procuring large turbines from European manufacturers, due to the current weakness of the sterling currency against the euro.