



Wind Farm Optimizations Forest Management Opportunities

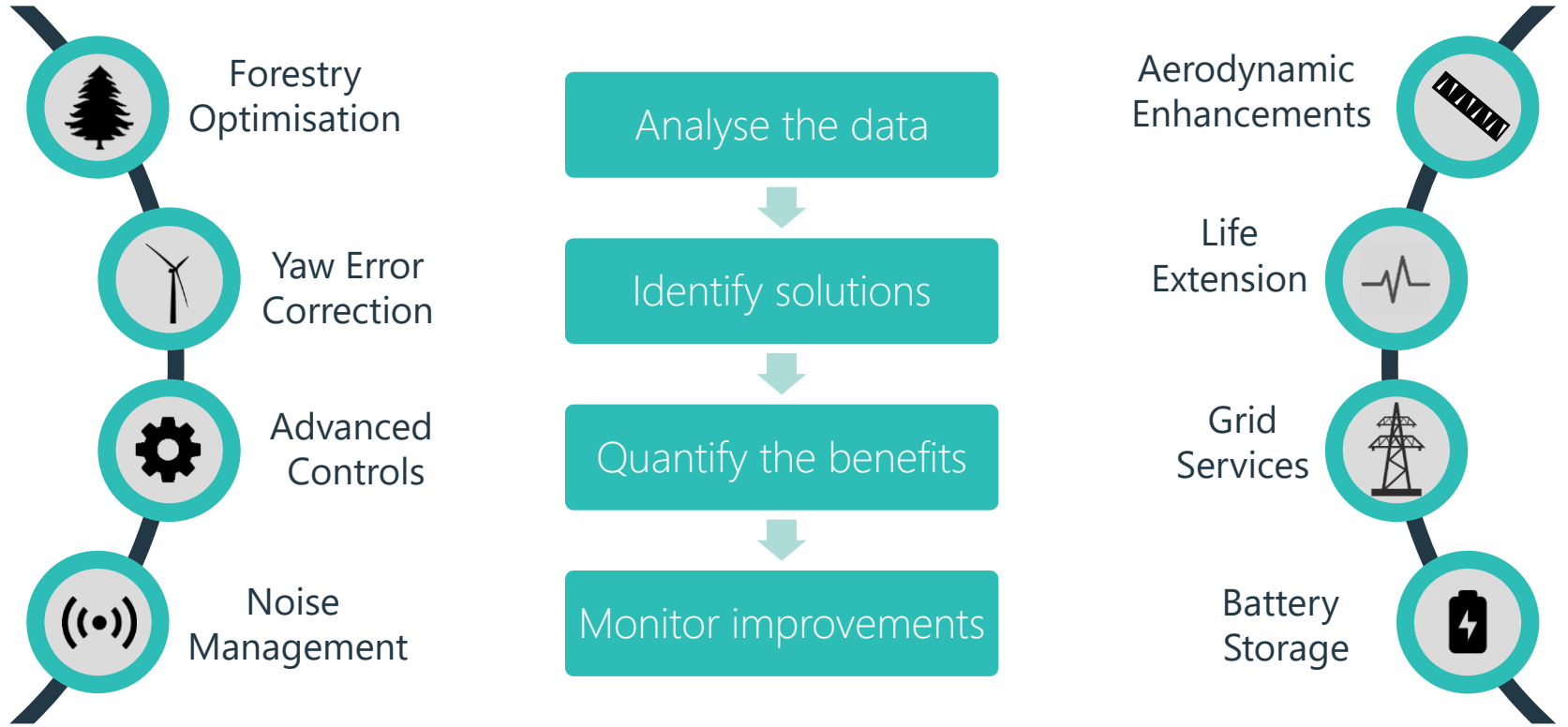
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Optimisation and life extension overview



Optimisation solutions



Forestry Management

Project Optimisation – Key Principles

- Fully understand the effect of terrain on wind
- Fully understand these effects on turbine performance
- Objective data-based approach using measurement (Galion lidar) and modelling (CFD)
- Fully understand forest owners management objectives
- Minimise development costs and risk
- Maximise full site resource efficiency
- Maximise wind farm NPV
- Holistic approach applies to wind farms in development and operational



Wind Farm Related Adaptive Forest Management



- Maximise resource efficiency of the whole site
- Minimise premature woodland clearance
- Use FDP process to maintain forestry objectives
- Objective, data based assessment of WTG performance
- Use FDP to protect/enhance WTG performance
- Long term strategic approach



Forestry Optimisation - Development

- Forest Design Plan is key
 - Information on tree crops (age, species, yield class)
 - Existing felling and restocking plans
- Recognise Control of Woodland Removal Policy and UK Forest Standard
 - Avoidance of large scale premature felling and resulting compensation payments/compensatory planting costs
 - Avoidance of tree clearance/timber sales management costs
 - Reduce consenting and reputational risk
 - Maintain forest owners silvicultural objectives
- Modify FDP to reflect wind farm requirements



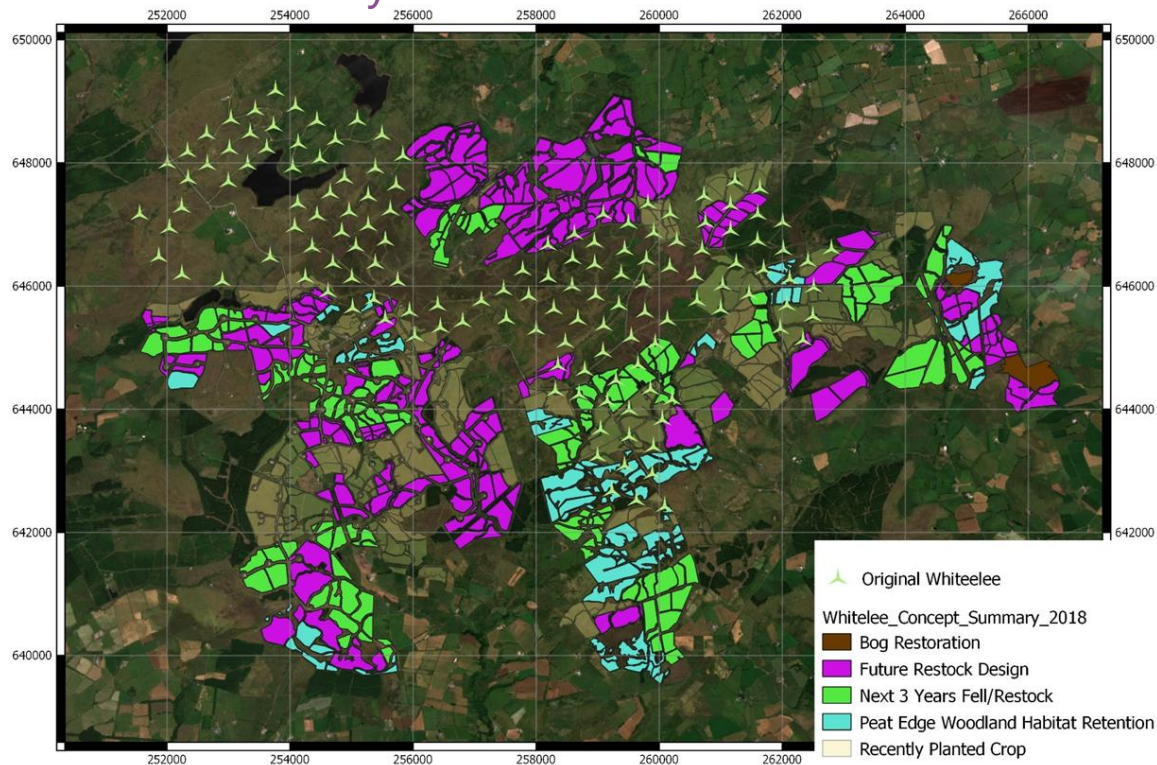
Wind Farm Forest Design Plan

- Iterative process between landowner and developer
- Identify areas most likely to impact on WTG performance
- Priority areas for felling identified and agreed with forest owner – where possible areas already scheduled for felling
- Restocking plan agreed to secure long term optimal WTG performance
 - Open ground
 - Native woodland
- WFFDP foundation of Habitat Management Plan



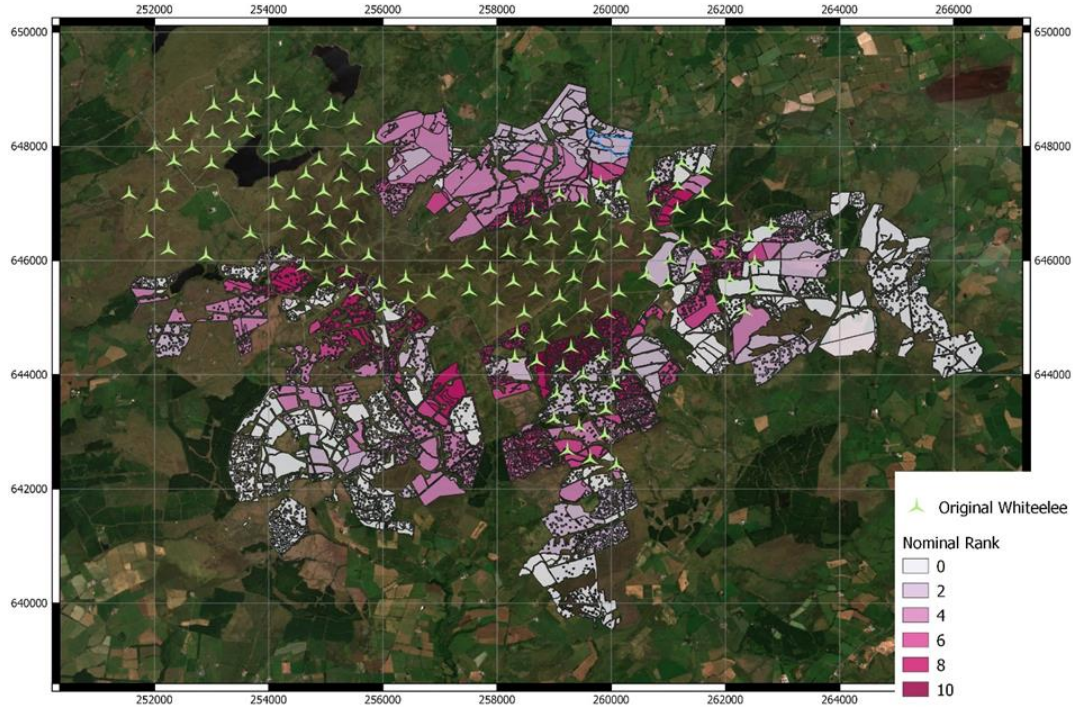
Forestry Optimisation – Operational Sites (Whitelee)

Review of current forestry status



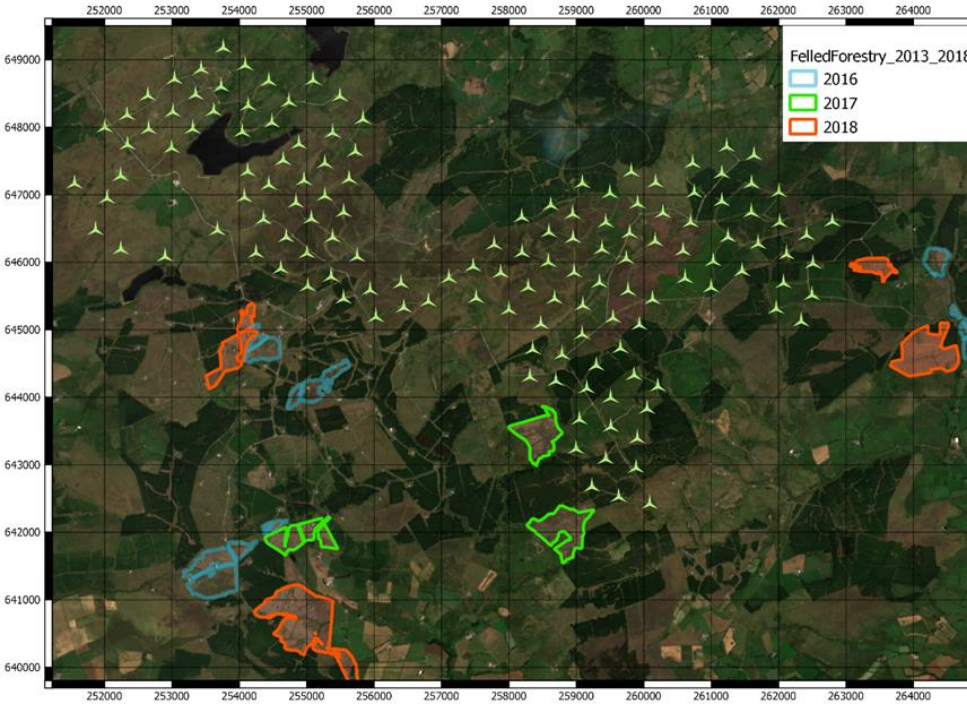
Whitelee Forestry Optimisation

WTG Exposure to Forestry and Forest Impact Assessment



Whitelee Forestry Optimisation

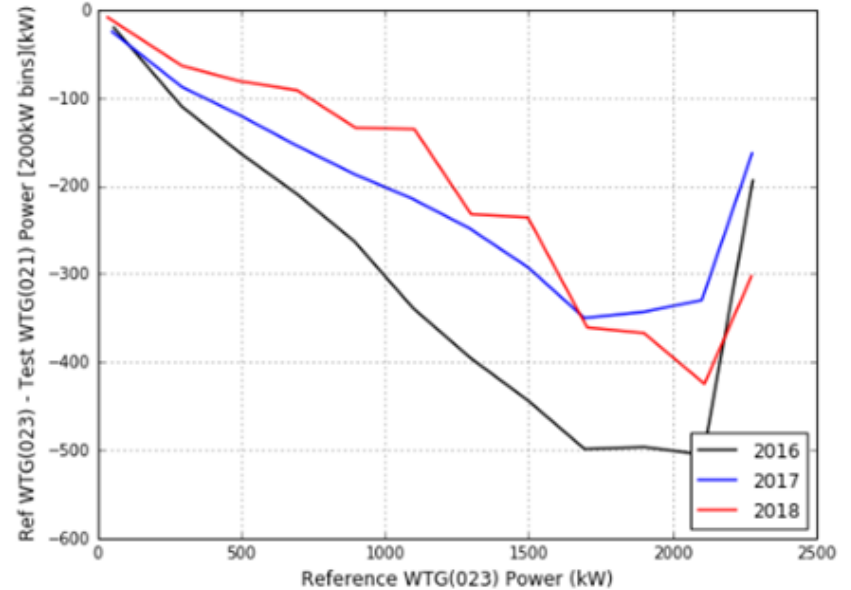
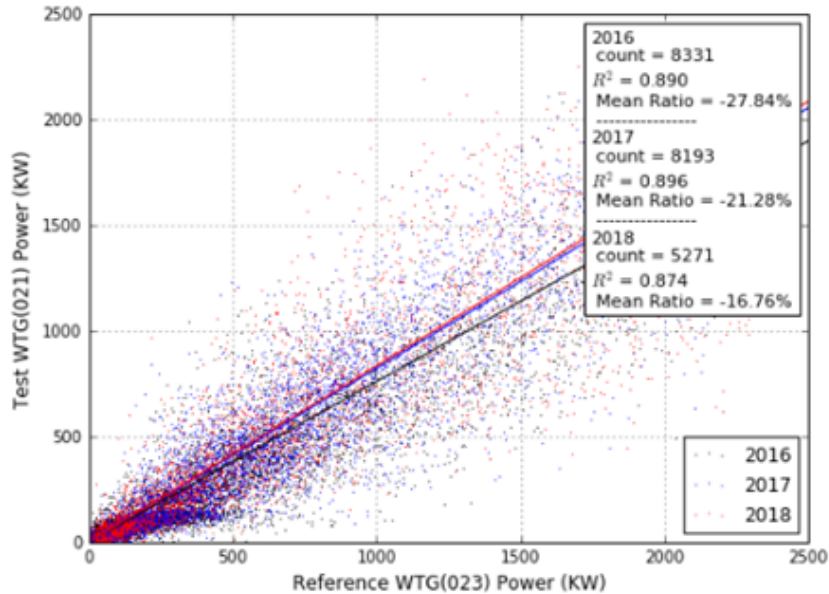
Case Studies – Impact of felling on WTG performance



Whitelee Forestry Optimisation

Case Studies – Impact of felling on WTG performance

Test WTG 021 in directions between: 190-230 (22.0% of ST Period)





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