**Dynamic wake modeling**

Wind farm performance is affected by wake losses occurring within, which result from downstream turbines facing slower and more turbulent wind due to upstream turbines. An accurate estimate of these wake losses is necessary to assess the annual energy production (AEP) of a given wind farm. Additionally, identifying wind directions that lead to the highest wake losses can serve as a basis for developing control strategies at the farm level. For example, a strategy may involve slightly reorienting the upstream turbines to redirect the wakes away from the downstream turbines. Suitable modeling of wind farm flows, especially wakes, is necessary for these purposes. The currently used models typically provide **steady-state solutions** only, **assuming that the time scales involved are sufficiently large**. However, it is known that changing the operating conditions of an upstream turbine will not instantly result in an increase in power produced by the downstream turbine. There will be a delay as the new wake trajectory needs to propagate downstream. Results indicate that neglecting this delay could be one of the reasons for **inaccuracies in AEP estimations**. Therefore, there is a genuine **need for fast dynamic wake models that include time-dependency in the modeling**. This need is particularly important when designing closed-loop **wind farm control strategies**.

**The goal of the internship will be to investigate open-source dynamic wake modeling tools and assess the increased accuracy they can bring to AEP estimation.** The tasks will include:

* Literature review of open-source low-fidelity engineering tools for wakes, such as FLORIDyn and PyWake.
* Integration of these tools into a benchmark of wake models.
* Analysis of the benefits that dynamic wake models could bring to AEP estimation.