How to Improve Energy Predictions?

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Why do we need to improve?

For wind to compete in the global energy market we need trust

- Trust from Developers / Owners to take projects forward
- Trust from Financiers to put money into wind projects

Wind already has the challenge of wind variability to deal with

- This has the potential to give Owners / Financiers surprises
- Need to reduce other potential sources of surprises

Power curves are a potential source of surprises

- There are complex technical issues to deal with
- Unlike wind variability the issues are under the control of our industry

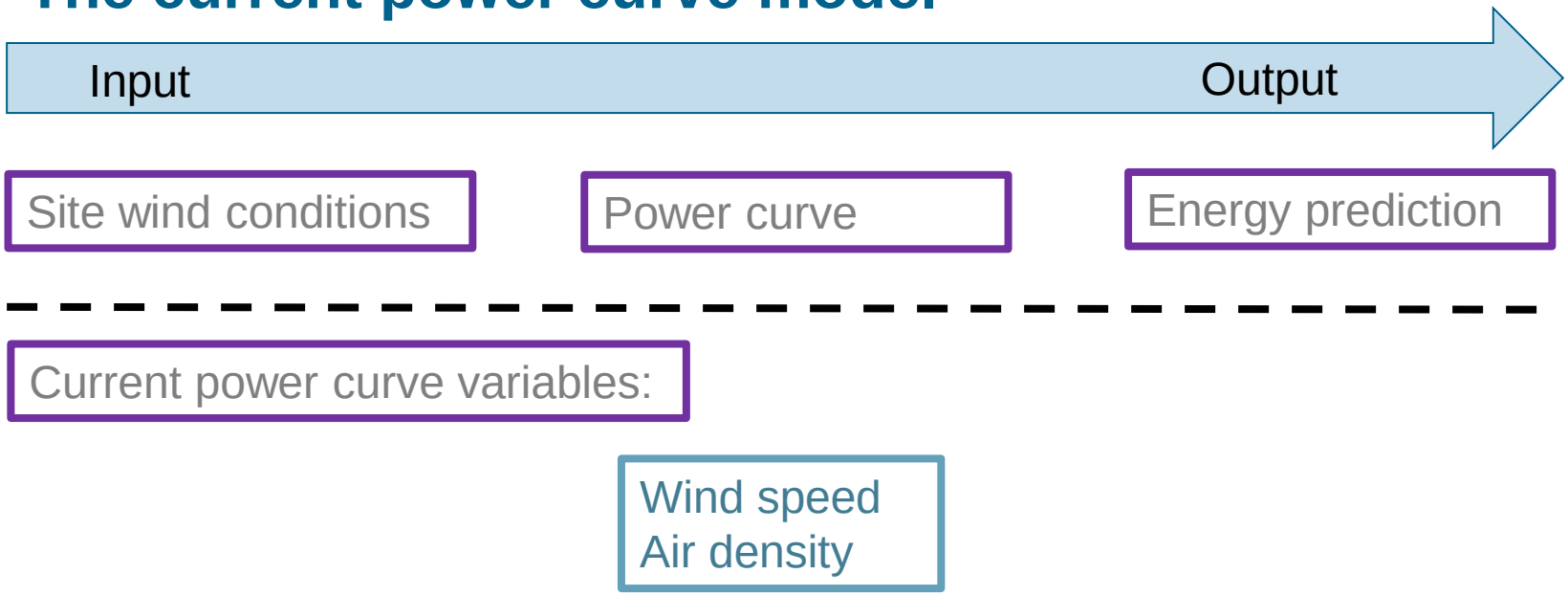
What about warranties?

Focus of this presentation is how we can improve predictions

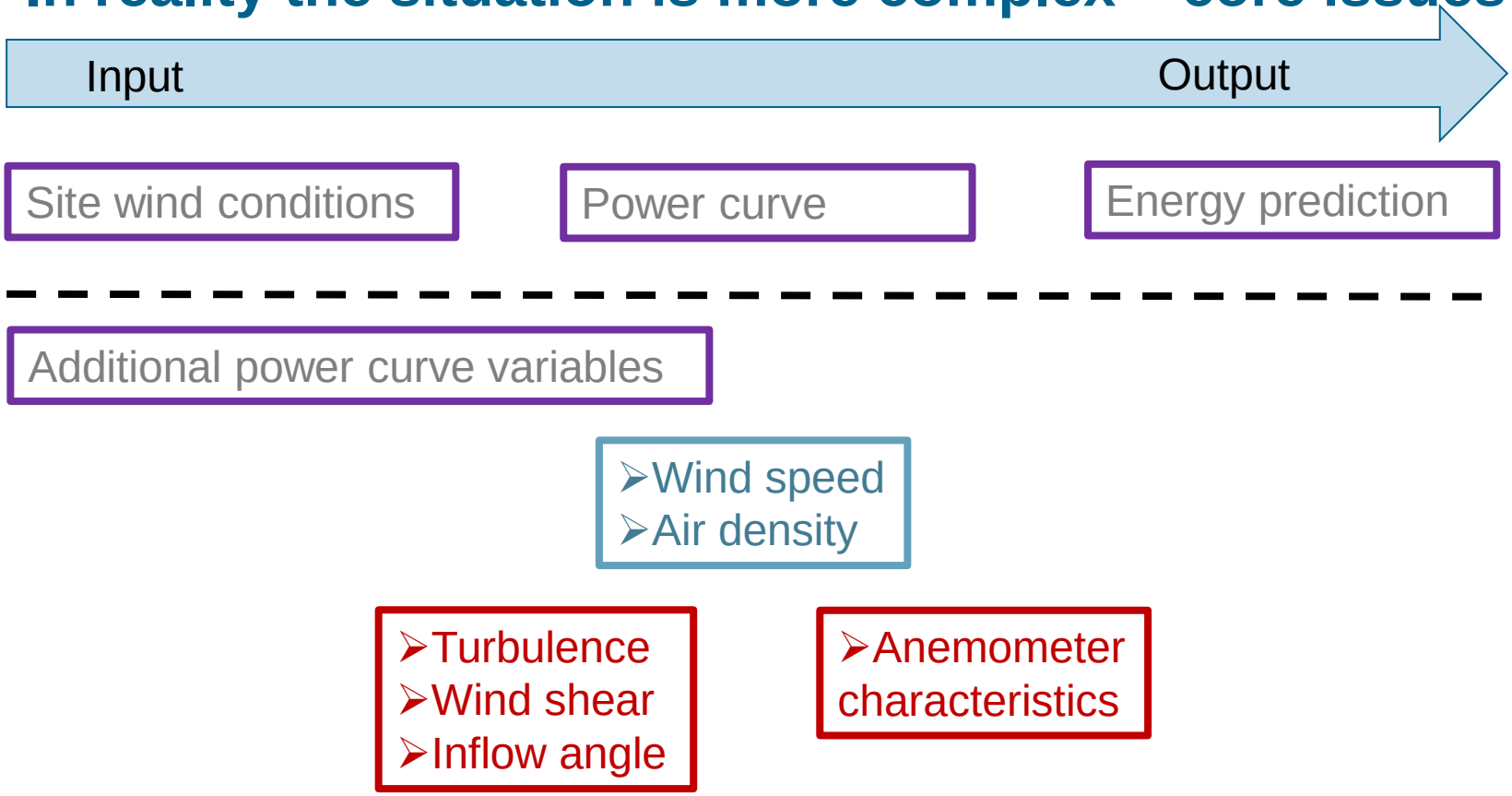
It would be naive to ignore the fact that power curves are subject to warranty arrangements – but these are commercial arrangements – and are outside the direct scope of this presentation

To make progress need to consider how predictions can be improved by better modelling the science of what is going on

The current power curve model



In reality the situation is more complex – core issues



These parameters vary with effects of terrain, roughness, atmospheric conditions and wakes of other turbines

Site measurements may use different sensors from sensors assumed for sales power curve

There are other issues which impact power performance

Site wind conditions

Power curve

Energy prediction

Power curve – additional issues which impact energy prediction

- Blade issues
  - Fouling
  - Icing
  - Surface degradation
- Curtailment
  - Loads
  - Power
  - Environmental
- Hysteresis algorithms
  - Cut in parameters
  - Cut out parameters
- Sub-optimal performance
  - Sensor issues
  - Software issues
  - Other issues

What would help improve predictions?

Theme 1 – Definition of the problem

Agreement of the variables to which a power curve is sensitive

What would help improve predictions?

Theme 2 – A clear starting point

A specific definition of the conditions for which a sales power is representative

Improved knowledge of the information used to define the sales power curve

What would help improve predictions?

Theme 3 – Improved models and measurements

Improved models to allow power curves to be adjusted on a site specific basis for all variables to which a power curve is sensitive

Changing site specific measurement campaigns to provide better data as inputs to power curve adjustment models

What would help improve predictions?

Theme 4 – Information to improve models for “additional issues”

Improved information exchange to better model:

- Curtailment
- Hysteresis algorithms
- Blade issues
- Sub-optimal performance

Questions?
Discussion to be continued in afternoon