

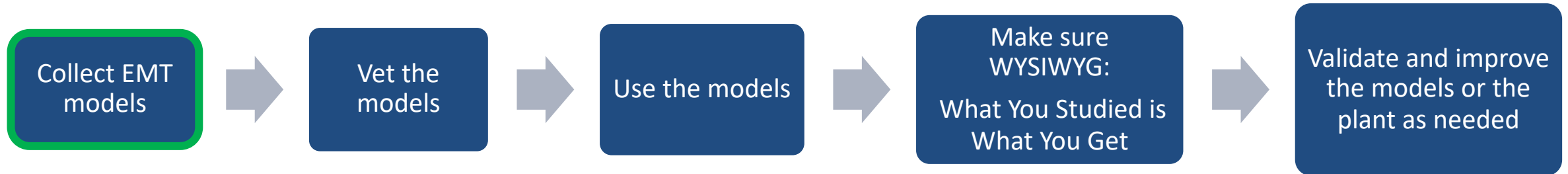
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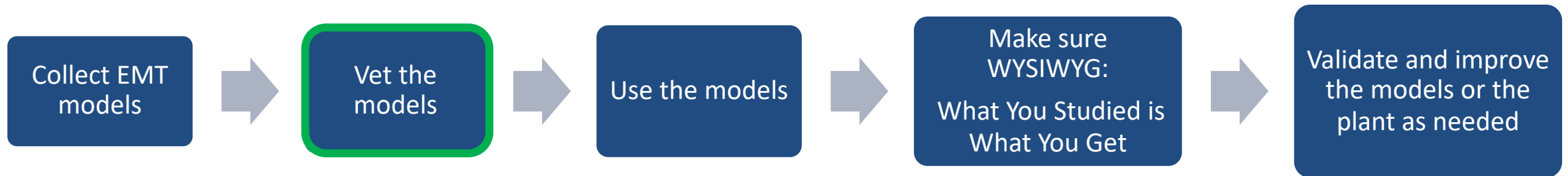
# EMT Model Life Cycle

Where we need to go

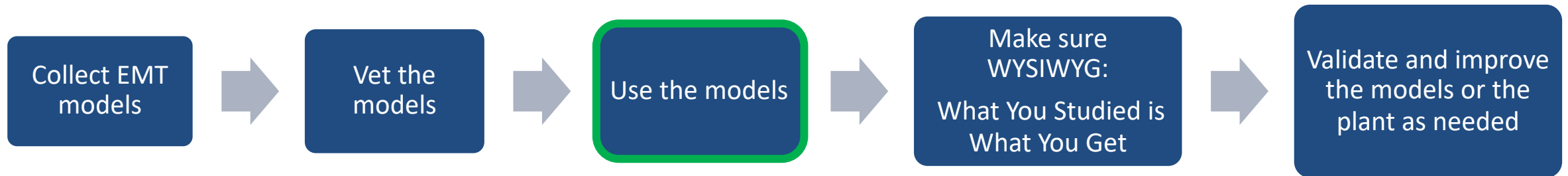
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- Collect EMT models *regardless* of study need today
- Require high quality EMT models as a prerequisite of interconnection
- Establish EMT modeling requirements per FAC-002 for all new IBR resources
- Create a “checklist” of EMT model requirements for GO and equipment manufacturers
  - Require the EMT models accurately represents all pertinent controls, and protections that could affect the electrical output of the facility during and after grid disturbances
- Require all submitted EMT models include
  - Attestations by the equipment manufacturers, accompanied by model validation and
  - Attestations by GO that aggregate model represents the entire plant and includes site-specific models, settings, protections, and controls
- Include change management requirements and protocols regarding how changes should be reflected in EMT models by the GO



- Go through and complete the checklist
- Verify documentations (attestations and validation reports) to establish model accuracy
- Test model adequacy, usability and efficiency
  - e.g. Does the model initialize properly and reasonably quickly? Run the model and see how long it takes to reach steady state
  - e.g. Does the model follow set commands and plant limits? Set power commands within limits and see if it follows. Set them outside the limits and see if output is limited.

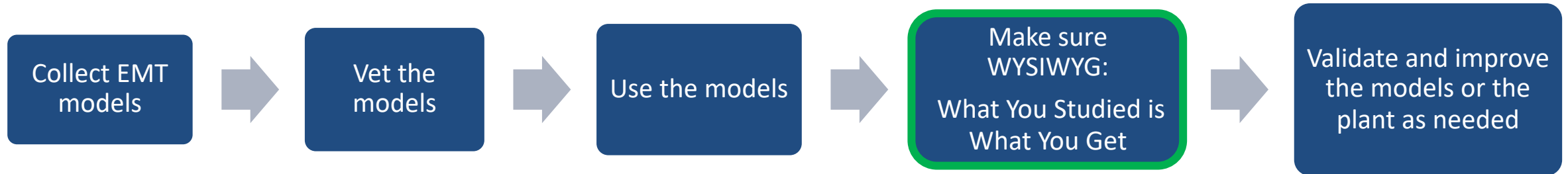


- Individual Plant Assessment
  - Once the model quality is vetted, test the IBR plant performance
  - Check if the plant performance meets interconnection requirements such as grid support functions, ramp rates, reactive capability, etc. (Functional Tests)
  - Check if the plant can ride through disturbances such as unbalanced faults of varying depth\*
  - Check if the plant meet performance standards such as IEEE 2800 or regional adopted variants
- System Impact Studies and Planning Studies
  - *When and how to do which* EMT studies – Scope of New Reliability Guideline
    - Dynamic performance studies, SSO studies, protection system validation study
  - Integrate in “EMT Base Case” after COD and plant level validation (new MOD-25)
  - Use for off-line operation studies

\* Detailed plant model maybe necessary in certain cases

- Prerequisite
  - Model quality verification such as model vs product validation reports, etc.
- Trigger for Study / Screening - Quantitative & Qualitative
  - Determine the need for EMT study (criteria) – what kinds of studies (study 1, 2, 3, etc .)
- Study Area Selection
- Modeling of Study Area and Boundaries
  - Which plants and to what level of details
  - How to model boundaries
- System Model Validation
  - Base case model benchmarking with other databases
- Critical contingencies





- Ensure WYIWYG (What You Studied is What You Get) before COD
  - Check if the installed equipment matches what was studied – types, versions, ratings and settings
  - True-up the models if installed equipment differs from the model attestations and assess the need for re-study

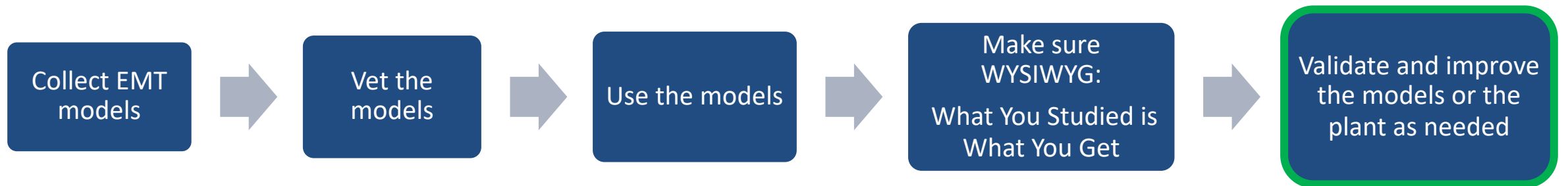
## Existing Problem Statement

*What was studied*



*What was installed*





- Validate and improve the model or the plant
  - Require DFR and to trigger *on grid disturbances* to get plant performance data to validate the EMT model
  - Any discrepancy should be sufficiently explained or addressed with software updates or model updates which may result in restudy and potential additional cost if new impacts are identified or special tuning is needed



# Questions and Answers

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