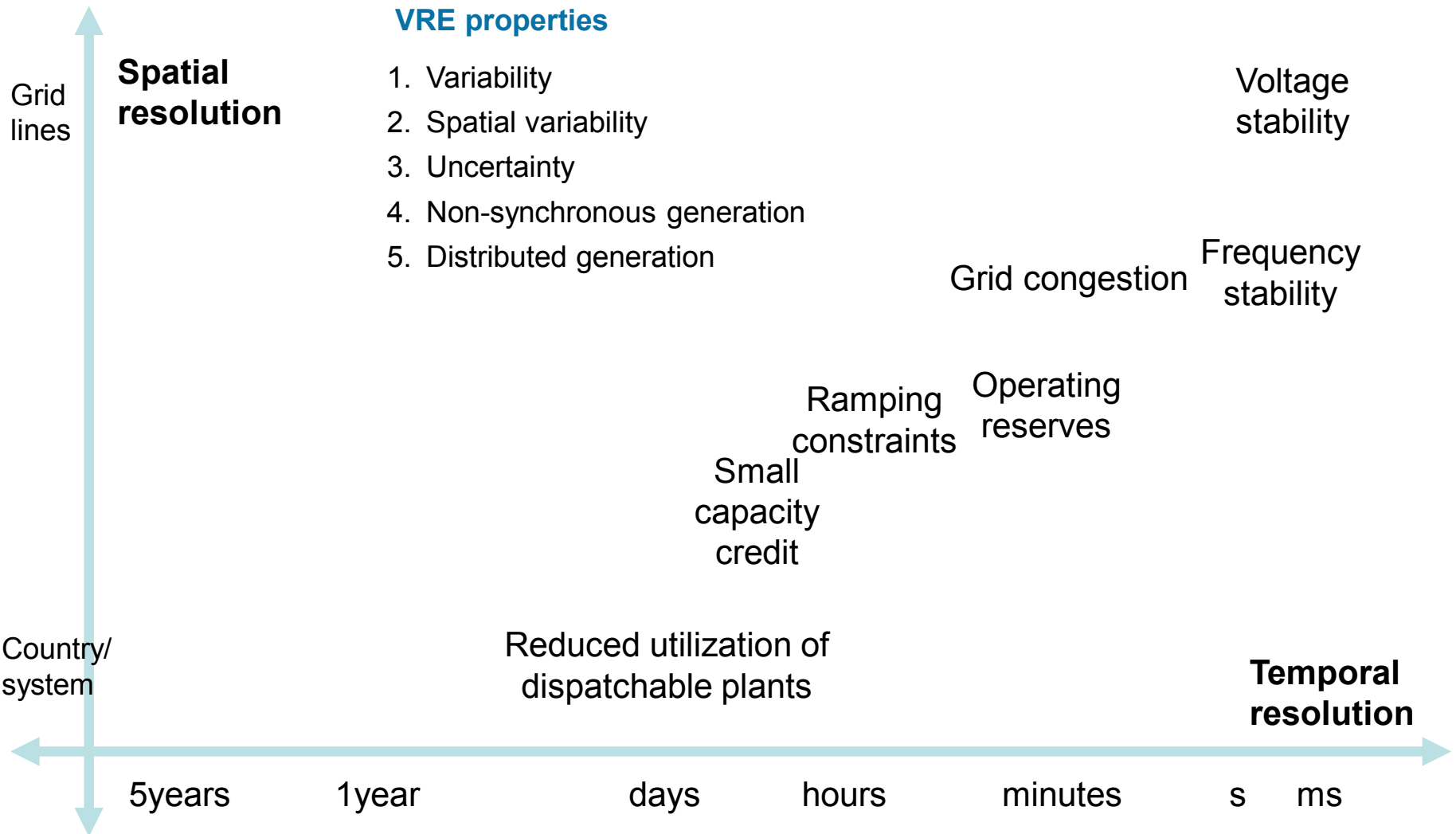
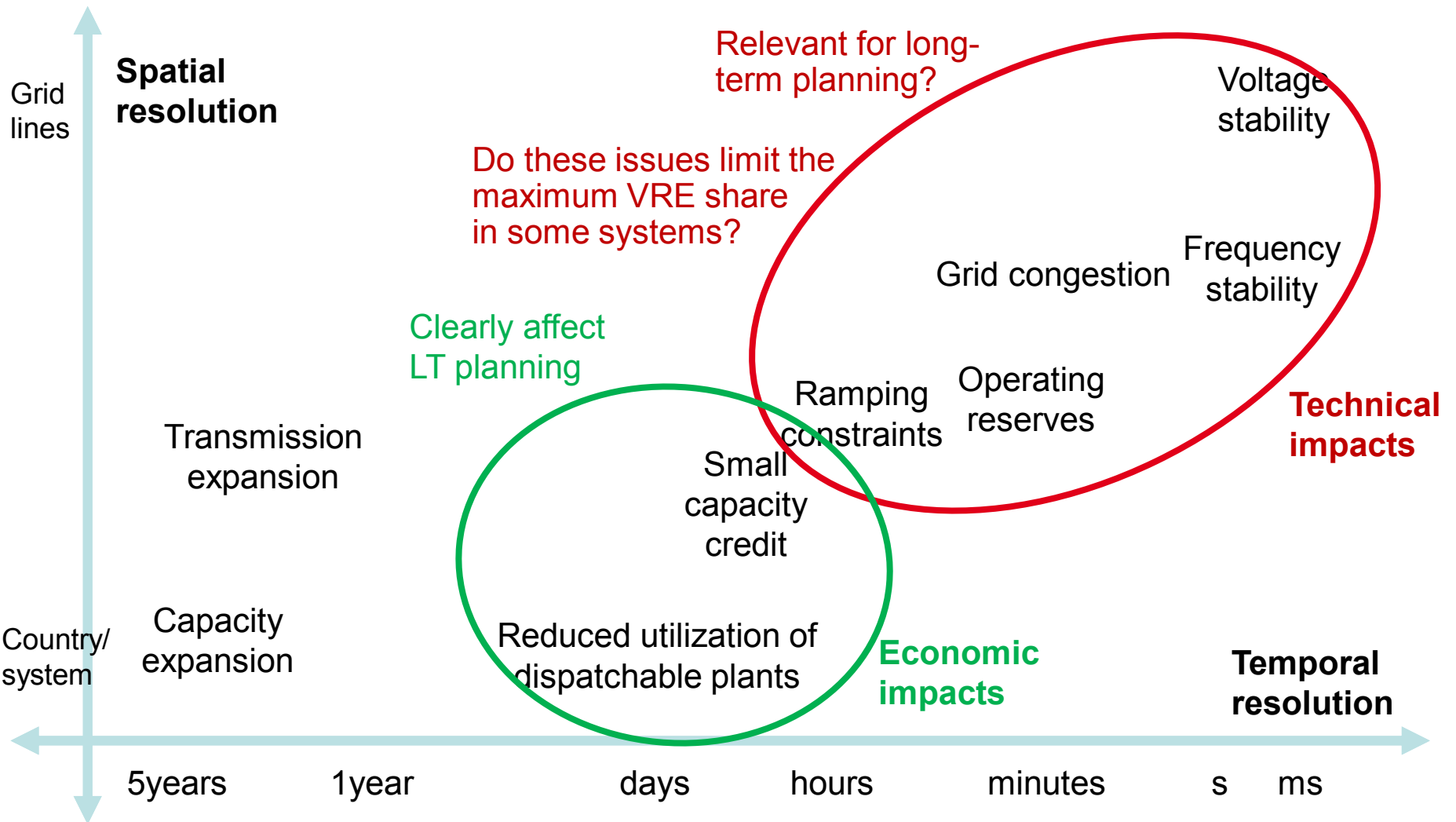


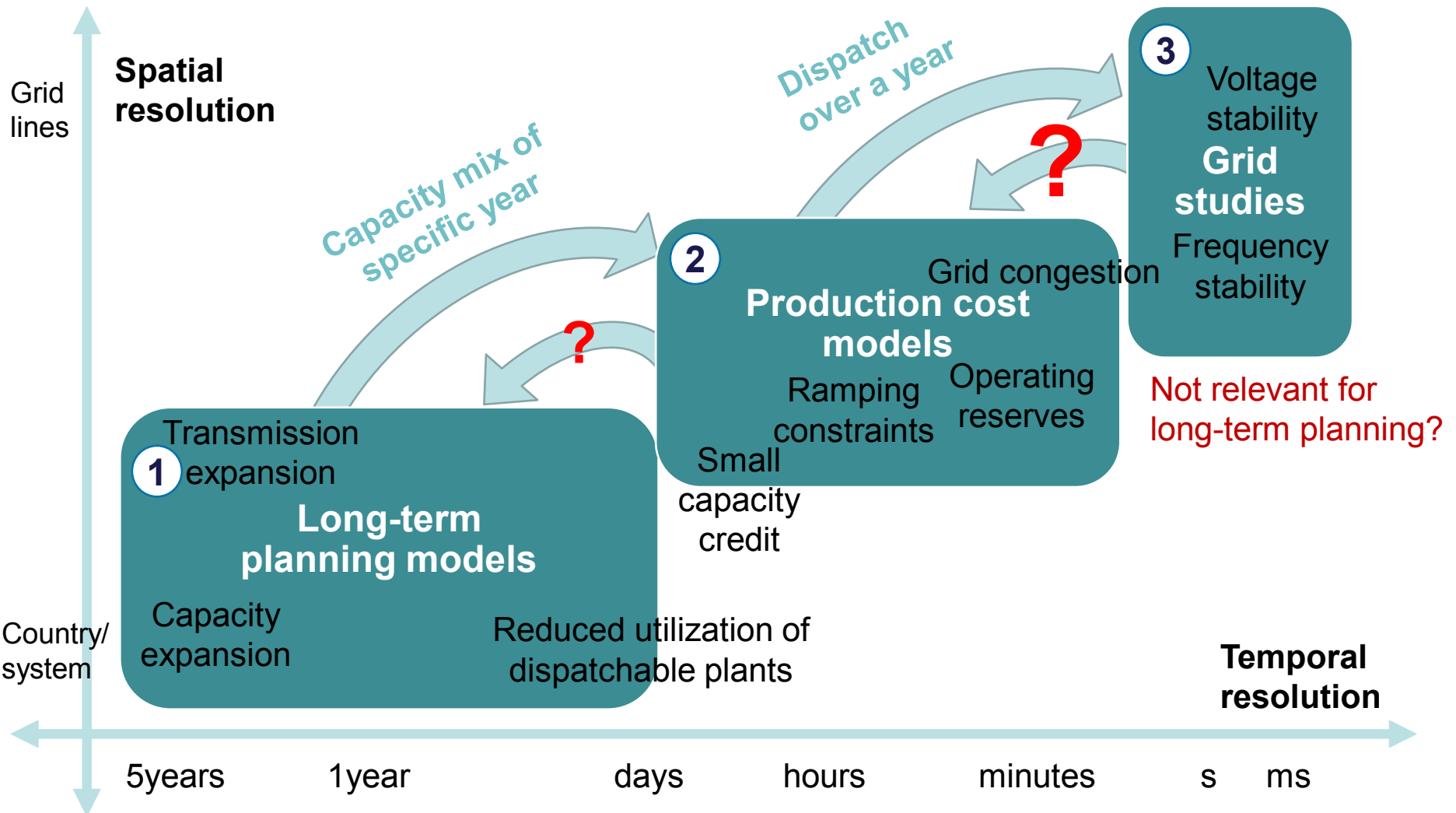
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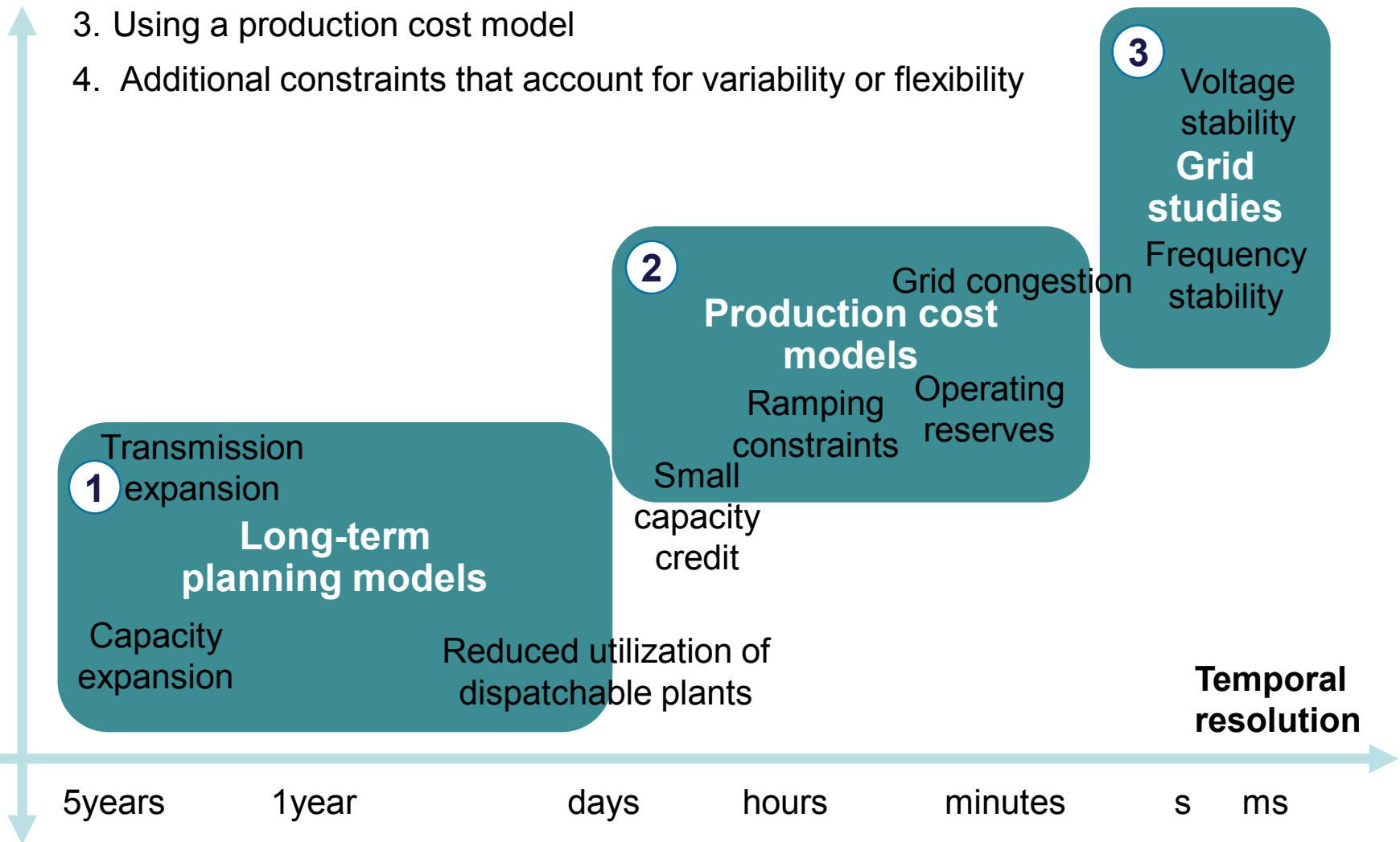


# Different models, different purposes and resolution



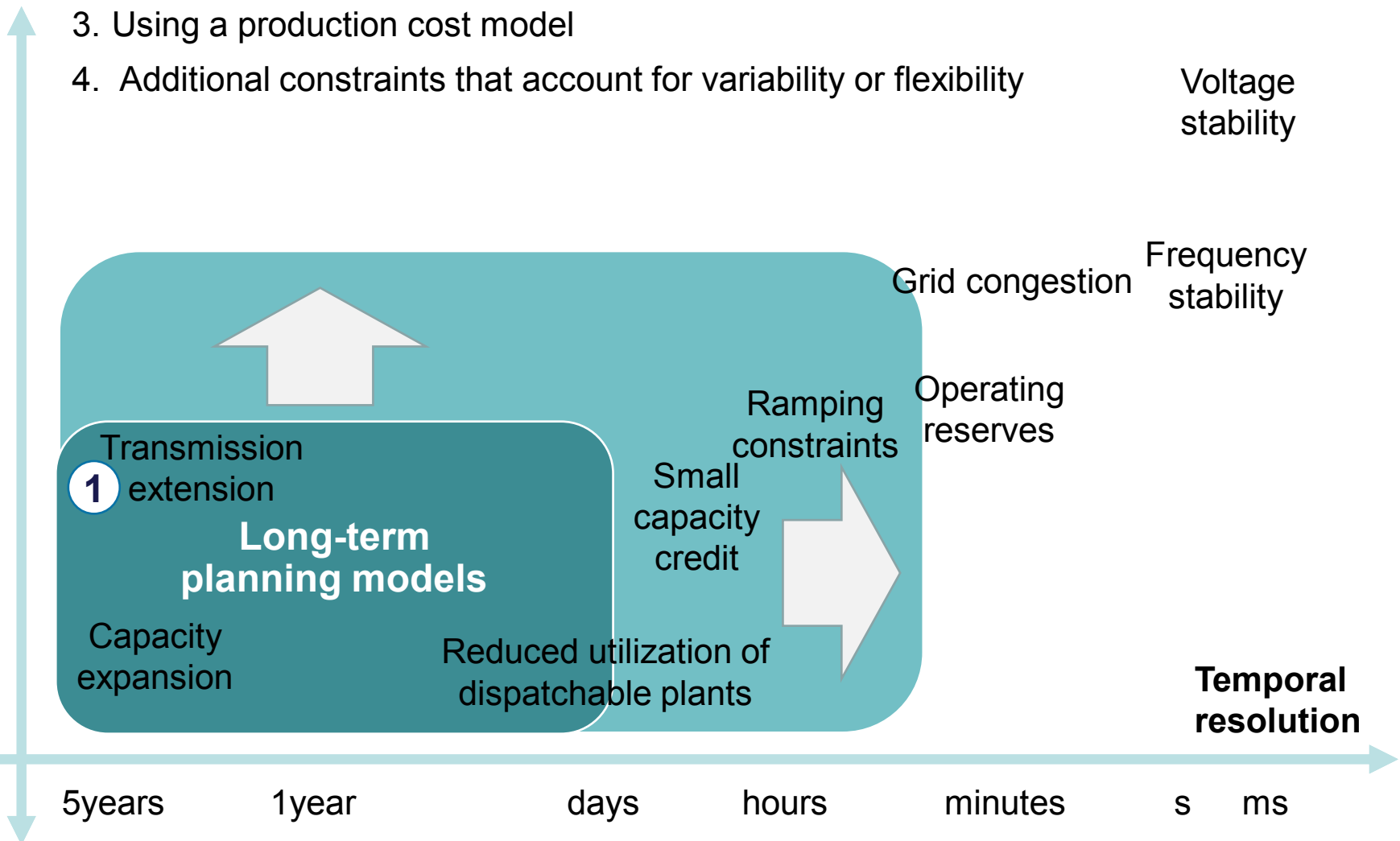
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2. Restructuring time to capture variability/flexibility with a low temporal resolution
3. Using a production cost model
4. Additional constraints that account for variability or flexibility



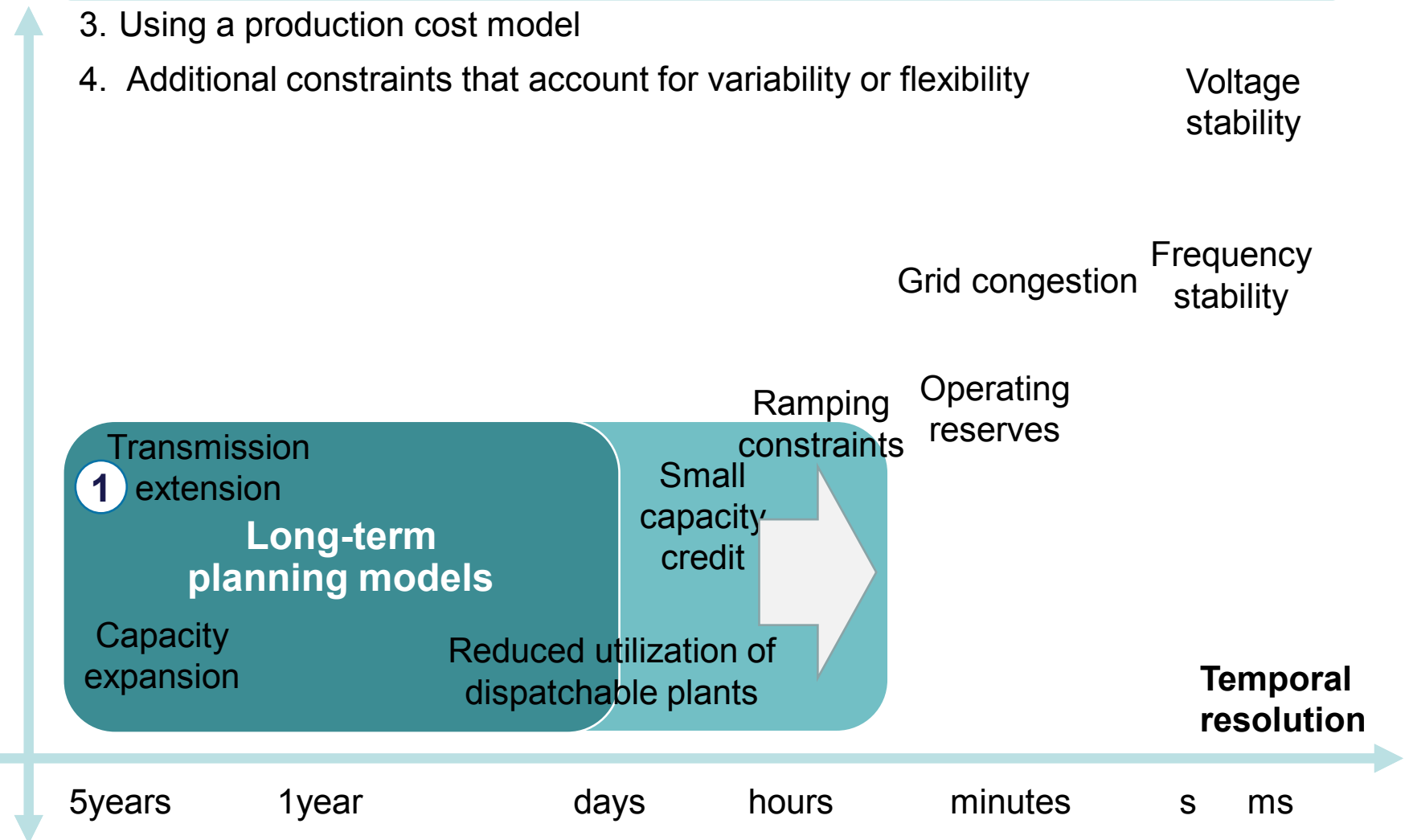
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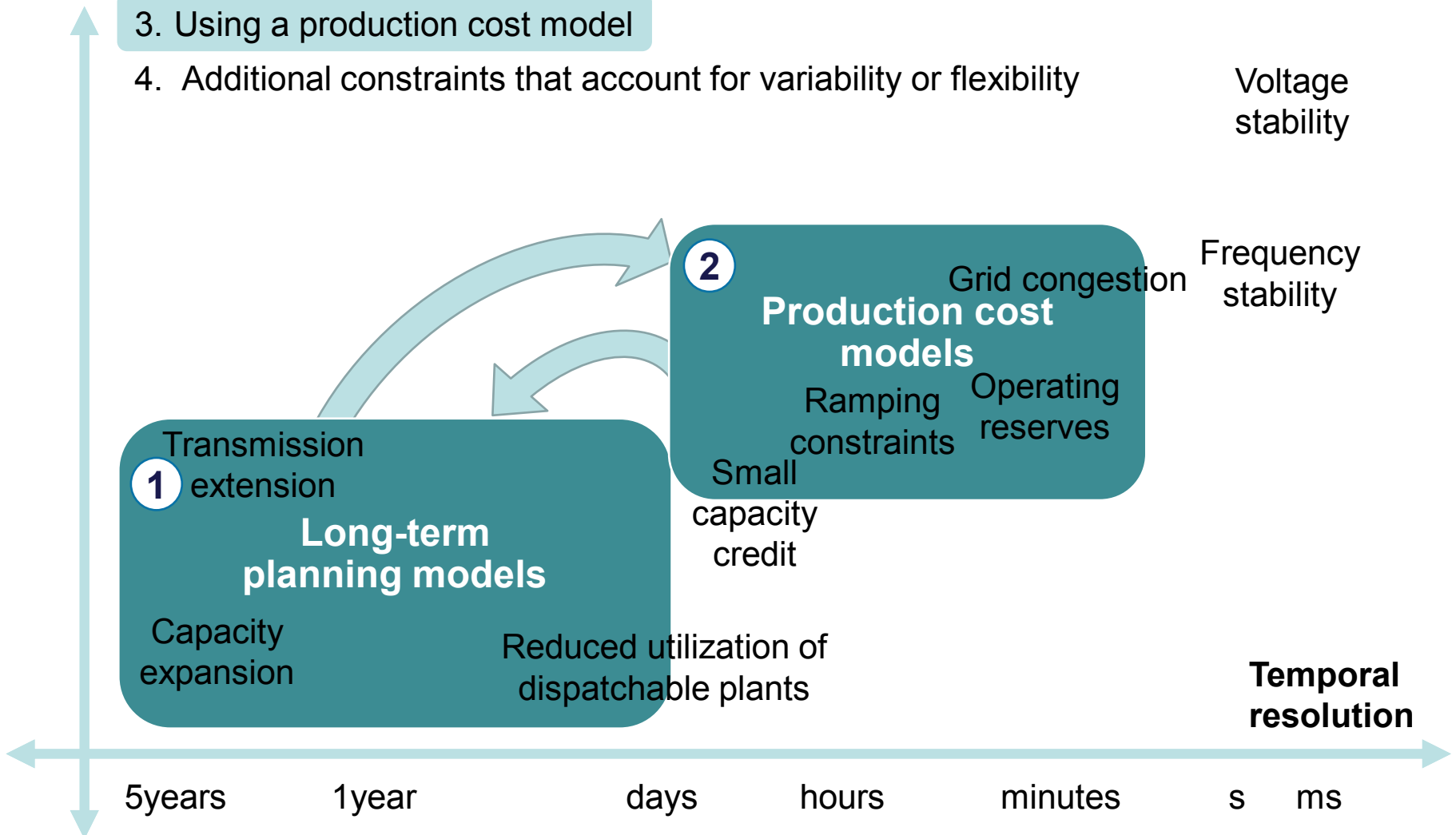
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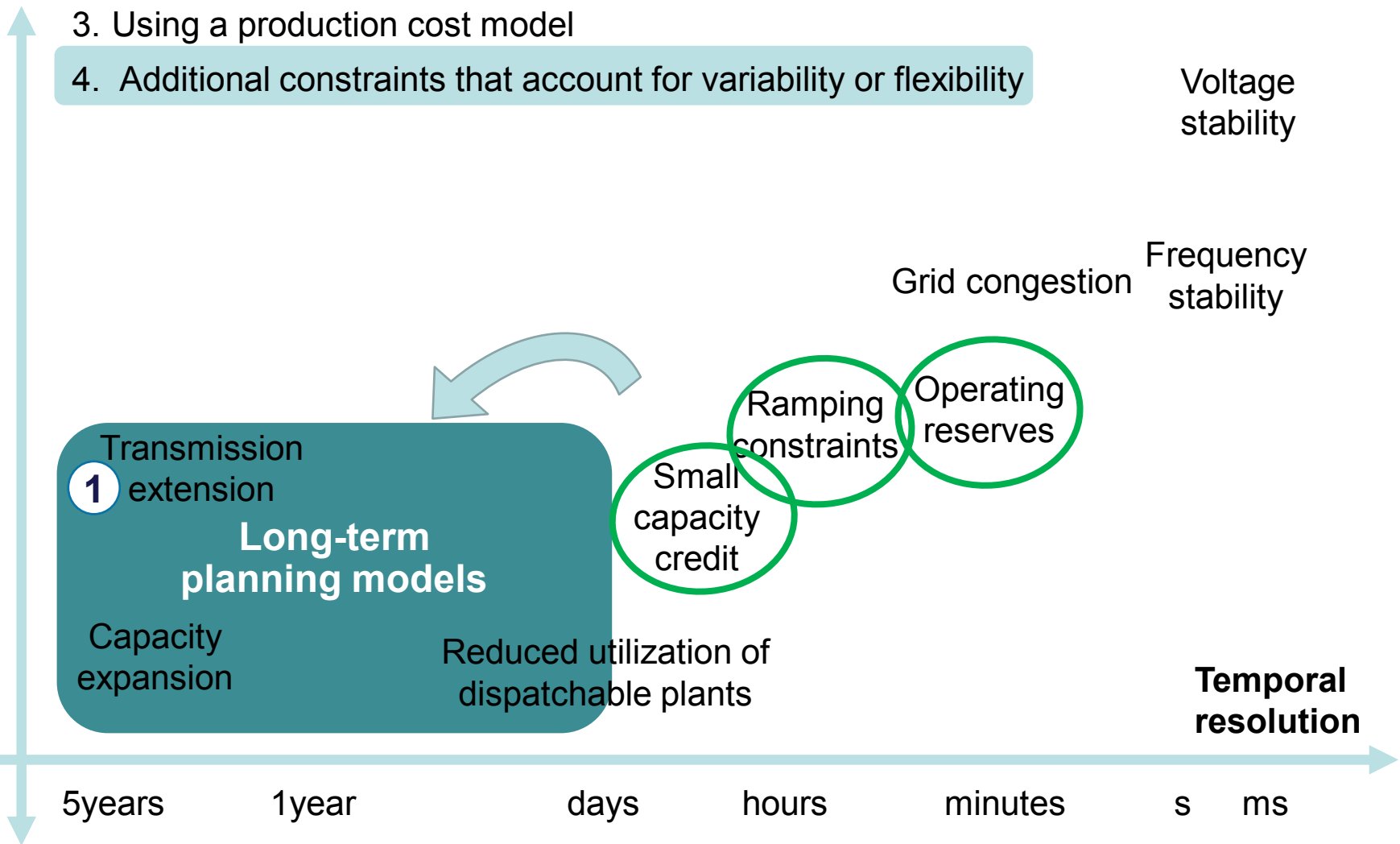
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# 4 approaches to account for variability/flexibility in long-term planning

## Approaches of accounting for variability and flexibility in long-term planning models

### 1. Directly increasing the temporal resolution

#### 2. Restructuring time to capture variability/flexibility with a low temporal resolution

##### 2.1. Representative time slices: load-based choice

Constructing temporal bins for average values of load and VRE based on load values for weekday, weekend, summer, winter; with arbitrary choice of VRE (high wind, low wind) (e.g. Standard TIMES)

##### 2.2. Representative time slices: clustering

Constructing temporal bins for average values of load and VRE based on clustering points in time with similar load, wind and solar values (e.g. LIMES)

##### 2.3. Characteristic days/weeks

Optimizing based on some highly resolved periods of the year

##### 2.4. Residual load duration curves (RLDCs)

Optimizing based on exogenous RLDCs (can be implemented via time slices)

#### 3. Using a production cost model

##### 3.1. Iteration with a production cost model

Soft-coupling the two models and iterating runs

##### 3.2. Parameterizing simple constraints (see approach 4)

##### 3.3. Validation

to validate other approaches of accounting for short-term aspects

#### 4. Additional constraints that account for variability or flexibility

- e.g. flexibility constraint (Sullivan et al), integration cost penalties (Pietzcker et al., Ueckerdt et al.), reserve capacity constraints (accounting for capacity credits), VRE curtailment, ramping constraint
- such constraints can be parameterized by models, data analyses or technical-economic parameters

## For discussion

- Do you find the suggested structure helpful?
- Are there more approaches?
- Relevance of characteristic weeks?