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Electric

# Transmission Planning Criteria

TAP Transmission Subcommittee

October 4, 2021

# Agenda

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- ◆ Transmission Planning Criteria
- ◆ IGP System Security Methodology





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# HECO Transmission Planning Criteria Review

Internal Use Only

# Contents

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- ◆ Background info
- ◆ Summary of Previous Review
- ◆ High level summary of updates
- ◆ Specific updates
- ◆ Future updates



# Background Info

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- ◆ Last update of Transmission Planning Criteria – Feb 1997. Did not take into account current and future renewable proliferation.
- ◆ 100% renewable is approaching...
  - Retirement of fossil generation
  - PSIP directive to reduce “must-run” generation for system security
  - More and more DER (lack of controllability and observability)
  - Evolving generation technology – GFM
  - Segmentation of “accessible” transmission lines
- ◆ Integrated Grid Planning
  - Take transmission constraints/needs into consideration of resource planning
  - Identifying grid needs under high penetration of renewable scenario
- ◆ Over the past two years, a significant amount of effort has been spent to review the new transmission planning criteria by IGP TAP, and Company internal stakeholder. The criteria was never finalized.



# Background Info (Cont.)

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- ◆ Transmission Planning Criteria (1997 version)
  - Defined transmission system boundary.
  - Defined voltage and thermal loading limits.
  - Focused on system peak load scenario planning.
  - Defined more frequent, less frequent, and least frequent events for system stability study.
  - Addressing system stability from maintaining generation synchronism and avoiding load shedding.
  - Did not anticipate transmission and distribution renewable generation proliferation.



# Background Info (Cont.)

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- ◆ Survey of Other Utilities/RTO Transmission Planning Criteria
  - Align with NERC criteria (planning events, planning horizon, etc).
  - More complicated steady state voltage and thermal loading study (study both winter peak and summer peak, considering load modeling, more complicated voltage stability analysis).
  - Power quality requirements.
  - Not much contents specific to IBRs.



# Summary of Previous Review: IGP TAP and HECO Stakeholders

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- ◆ Supported inverter-based resource (IBR) related updates
  - Adding definition of IBR, DER, short circuit ratio, weak system.
  - Adding IBR as equivalent generation unit.
- ◆ Supported planning process related updates
  - Study more scenarios than just peak load scenario.
  - Defining near-term planning horizon as NERC's guideline, long-term planning horizon in conjunction with the IGP process.
- ◆ TAP Feedback incorporated
  - Quantifying damping ratio limit (3%).
  - Requiring EMT study in planning process.
  - Frequency stability study – adding UFLS review and frequency response resources performance review.
  - Adding Control Stability as a new stability category evaluated during planning process
- ◆ Parking Lot (Future Considerations)
  - Duration of emergency rating.
  - Specifying Control Stability criteria.





# Transmission Planning Criteria under Review

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- ◆ Planning Criteria Contents
  - Transmission system definition
  - Equipment thermal and voltage limits
  - System stability
    - Steady state voltage stability
    - Control stability
    - Rotor angle stability
    - Frequency stability
    - Planning criteria for different type of planning event
  - Planning process
    - Planning event
    - Planning horizon
    - Past studies



# Transmission Planning Criteria under Review

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- ◆ Weak Grid related new contents
  - Definition of Weak Grid (at least one node  $SCR < 3$ ).
  - Weak Grid Assessment - weighted short circuit ratio (WSCR).
- ◆ IBR related new contents
  - Generation unit and station related planning criteria also apply to IBR project.
  - Single point failure requirement.
  - Generating Facilities should interconnect to an existing substation if practical or interconnect to multiple transmission lines through a new standard transmission substation.



# Transmission Planning Criteria under Review

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- ◆ System Stability related new contents
  - Add damping ratio requirement (3%)
  - Add Steady State Voltage Stability criteria (PV, QV analysis criteria).
  - Add Control Stability for IBR system as a new category of stability.



# Transmission Planning Criteria under Review

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- ◆ System Stability related new contents

- Add frequency stability criteria:

*The system shall carry sufficient inertia and frequency response reserves to mitigate the loss of the largest generating unit, including any aggregate loss of distributed energy resources in response to the Contingency events*



# Transmission Planning Criteria under Review

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- ◆ Planning Process related
  - Consistent with NERC requirements
    - Planning event P0-P7
    - Near-Term planning process (5 years)
    - Long-Term planning process (in conjunction with the Integrated Grid Planning process)
    - Study scenarios
      - Day minimum load (high DER, low gross load)
      - Day peak load (low DER, high gross load)
      - Evening peak load
      - Night minimum load
  - Past studies



# Discussion

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- ◆ Emergency Conductor Rating Duration
- ◆ Primary Frequency Response and non-Contingency Reserve values. Should they be set to zero for transmission planning studies?
- ◆ Probabilistic transmission planning criteria



# Discussion & Questions

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- ◆ Emergency Conductor Rating Duration
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- ◆ Probabilistic transmission planning criteria





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# IGP System Security Study Methodology

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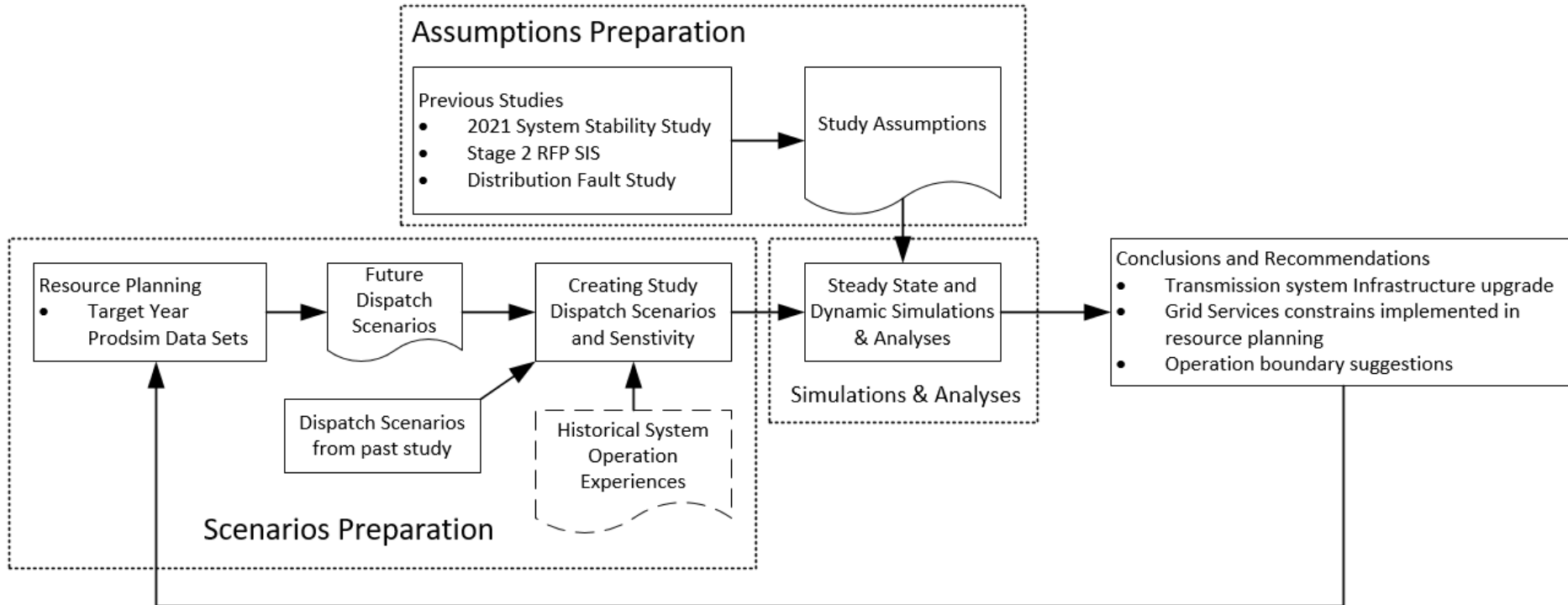
# Objectives of IGP System Security Study

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- ◆ An important step of integrated grid planning to confirm system security.
- ◆ By performing system security study, grid needs are identified
  - Capacity needs
  - Reactive power needs
  - Frequency response resource needs
  - System strength needs
  - Inertial needs
  - Others
- ◆ System security study are important feedback for system resource planning.



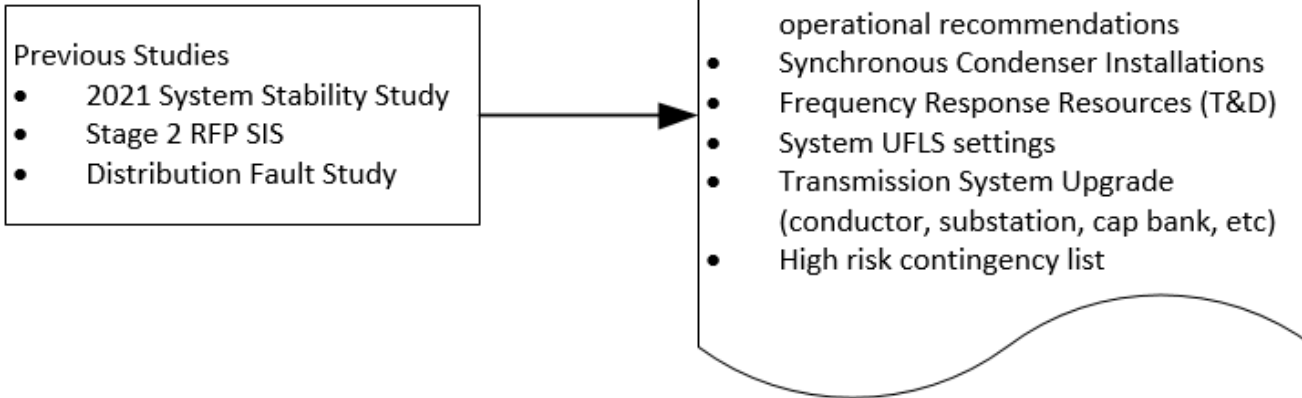
# Main Flow



# Assumptions Preparation

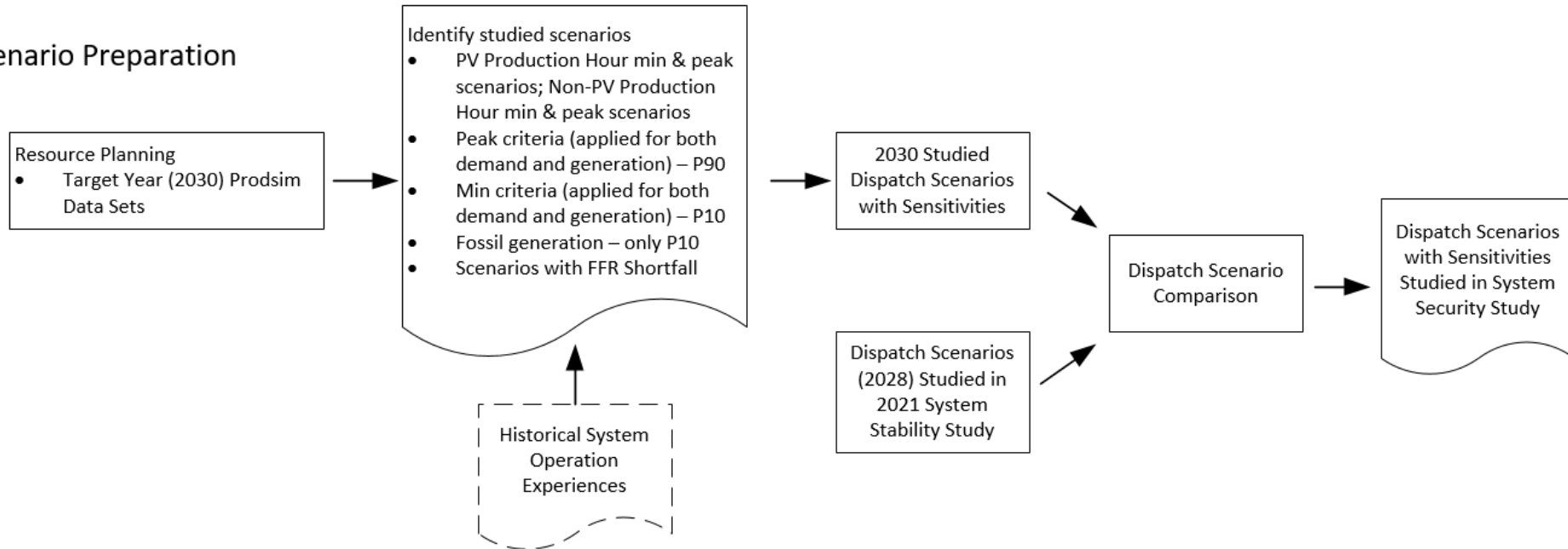
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## Assumptions Preparation



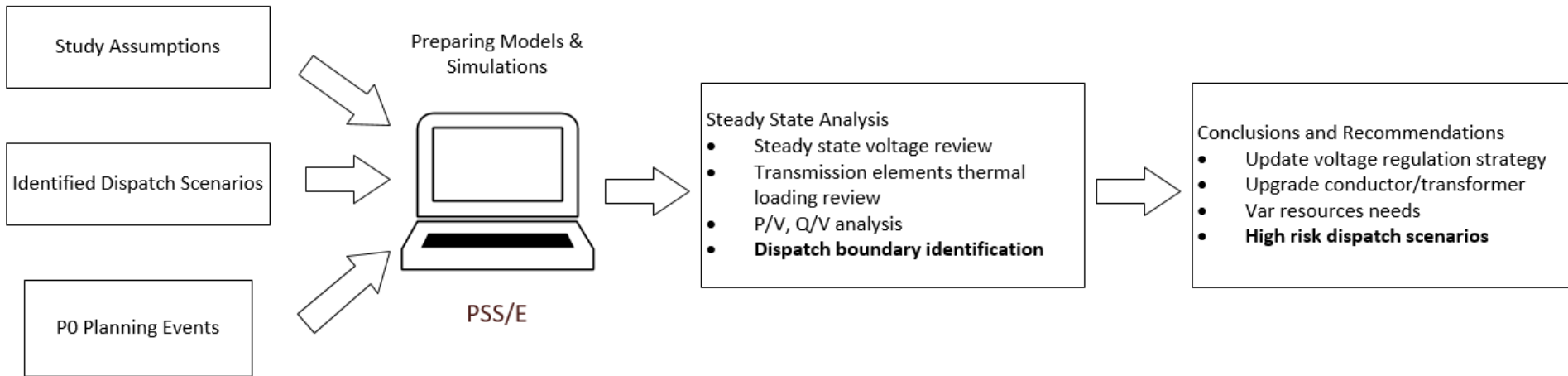
# Scenarios Preparation

## Scenario Preparation



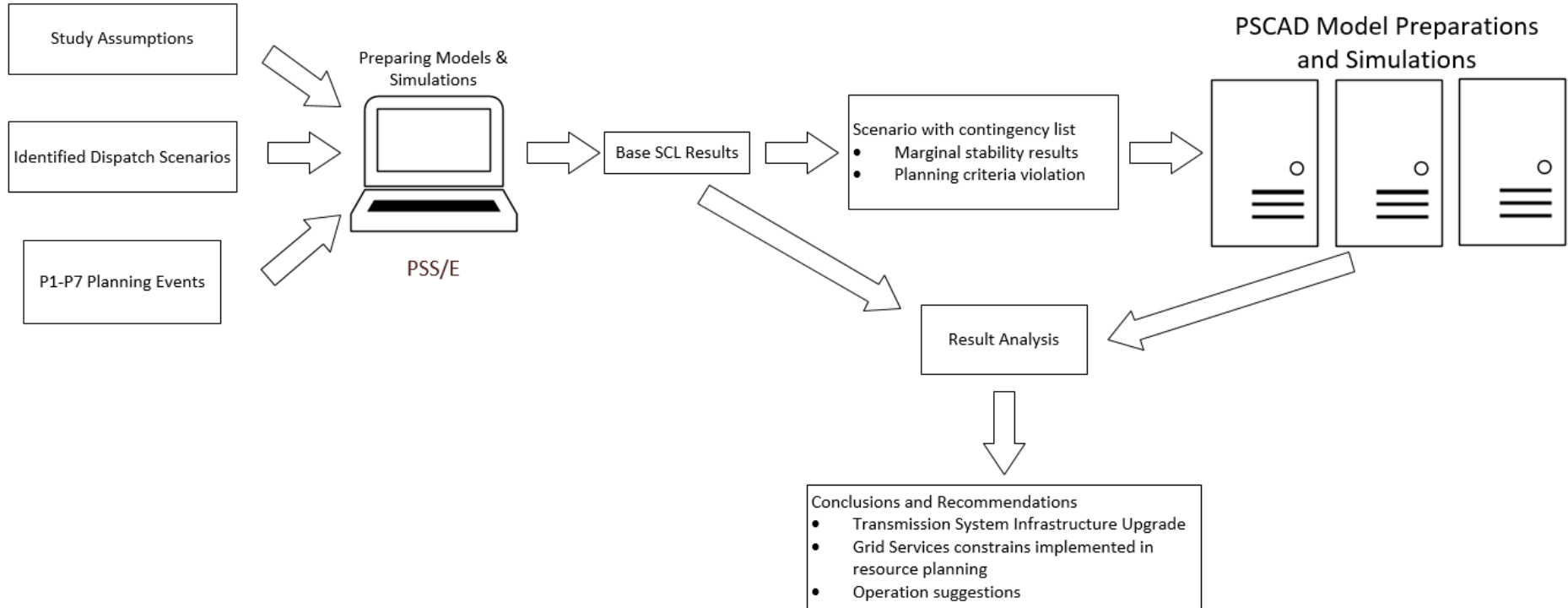
# Steady State Analyses

## Simulations & Analyses – Steady State Analyses



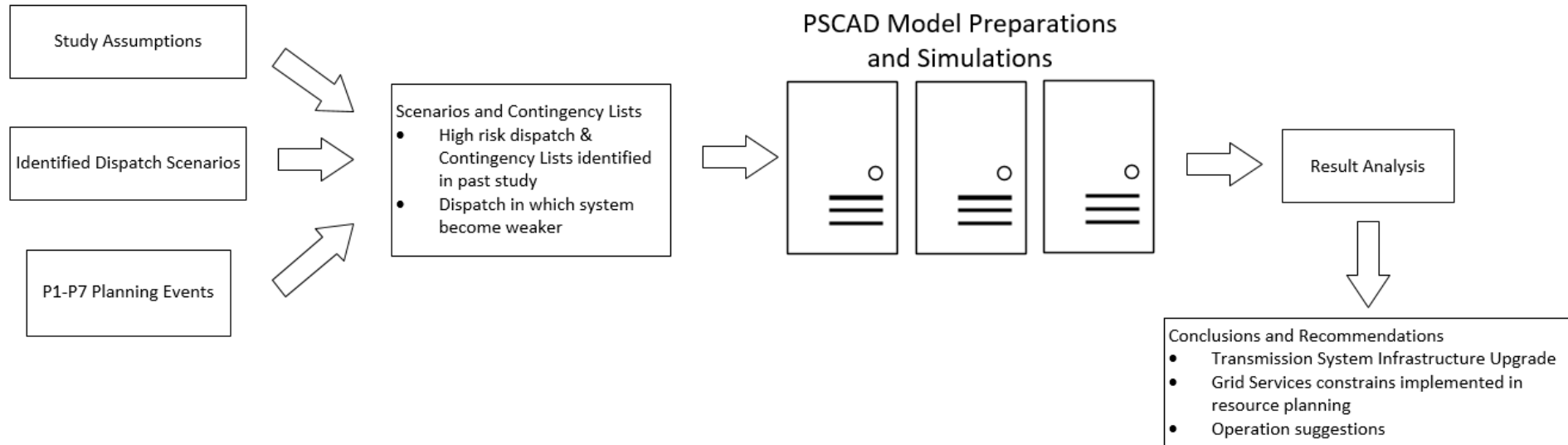
# Dynamic Analyses

Simulations & Analyses – Dynamic Analyses –  
Credible PSSE GFM Models Are Available



# Dynamic Analyses

Simulations & Analyses – Dynamic Analyses –  
Credible PSSE GFM Models Are Unavailable



# Grid Services Definitions

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- ◆ Minimum Inertia requirements
- ◆ Frequency response services
- ◆ System strength requirements





# Discussion & Questions

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- ◆ Feedback of using prod sim dispatch information/data as a basis for transmission planning studies? Particularly for future IBR dispatch scenarios for which historical operation and event data is unavailable for reference.
- ◆ Feedback for increase simulation efficiency when GFM PSSE model is not ready.
- ◆ Feedback for using proxy GFM PSSE and PSCAD model for planning study.





Mahalo for your time.

