RESTRUCTURING LACK OF RESERVE (LOR) CRITERIA

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CONTENTS

1. Background and problem
2. The solution
3. Variable variables
4. Bayesian belief networks
5. Contingencies
6. Publication
7. The Guidelines
8. Timeframes
9. Discussion

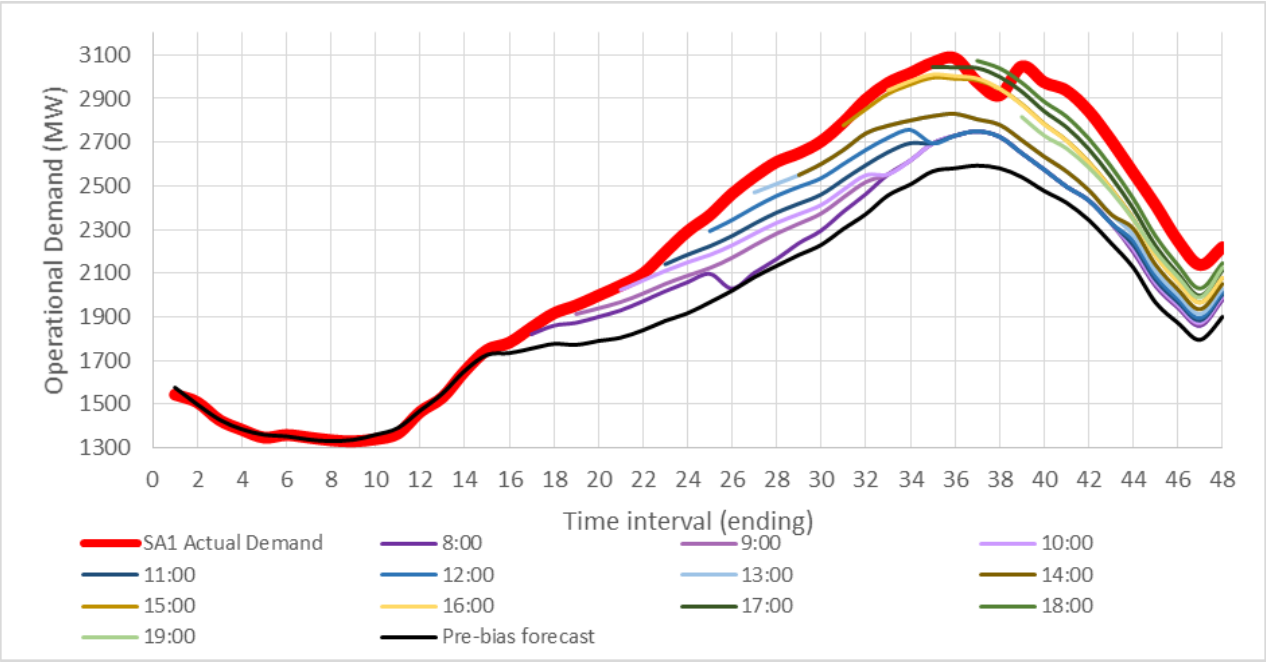
LACK OF RESERVE BACKGROUND

- LOR 1,2,3 are short-term (<8 days) alert levels
- Indicate risk of, or actual, load shedding
  - To seek a market response to the risk
  - If none, LOR2 & 3 can trigger AEMO intervention:
    - Recall network outages
    - Dispatch Reliability & Reserve Trader (RERT) Capacity
    - Direct participants
- LOR3: Actual, or expected (>50% likely) load shedding
- LOR2: Actual or expected minus largest generator**=load shedding
- LOR1: Actual or expected minus two largest generators=load shedding

**Some, but not all, network contingencies are also considered

THE PROBLEM

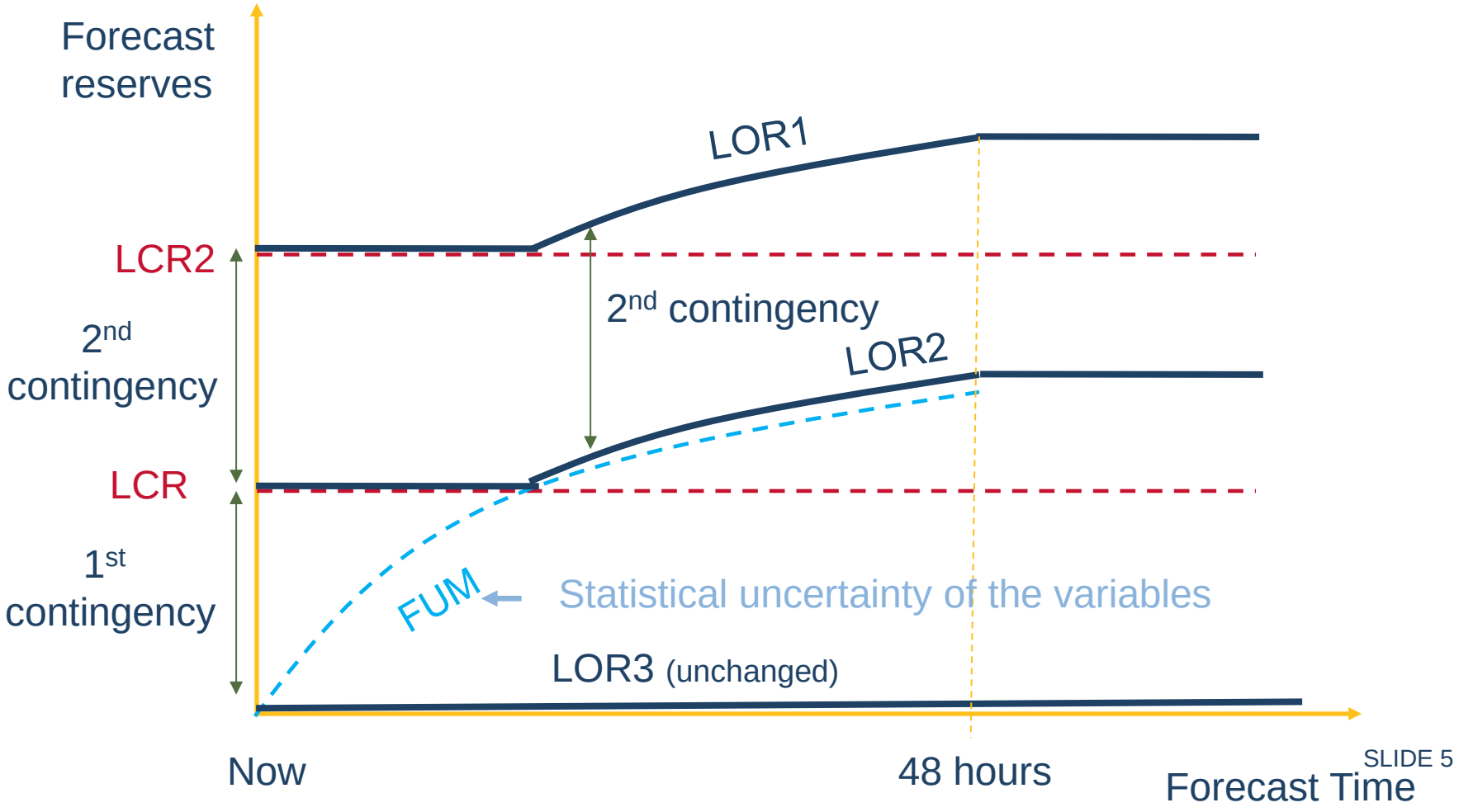
- Very simplistic way to assess reliability risk
  - Assumes variables, like demand and wind production, are constant (deterministic) and only large generators can fail
  - But the variables are getting more variable, whilst large generators are getting smaller
    - ➢ On 8 Feb, SA demand under-forecast by 400MW 4 hours out



- LOR2 observed only 1 hour before actual load shedding
  - No contingencies
- Too late for response or intervention

THE SOLUTION

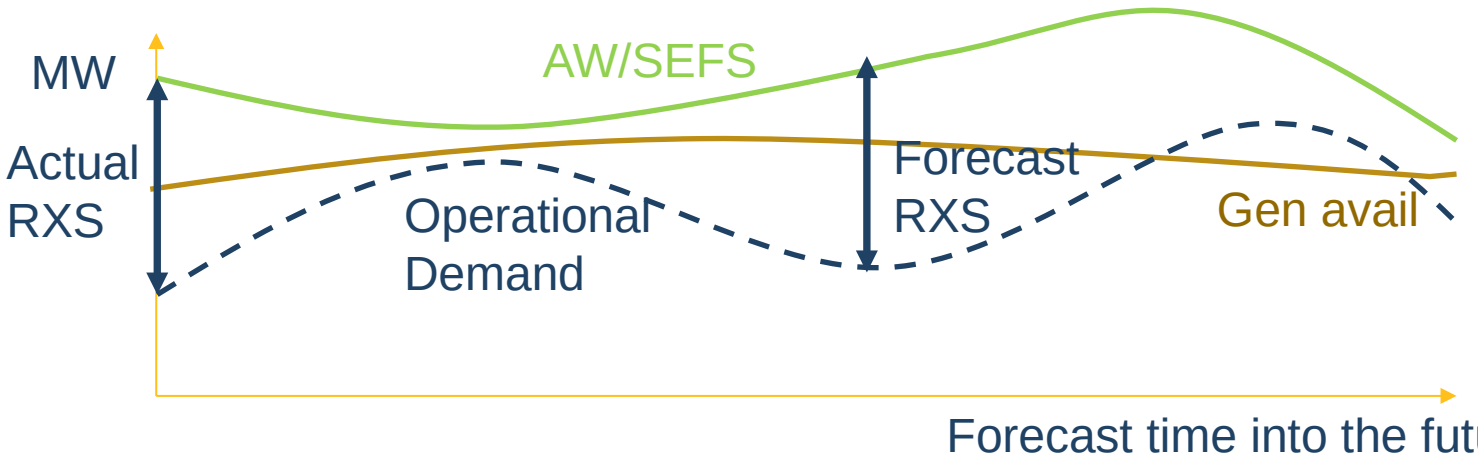
- Retain contingency risk, but also a probability of the variables moving unfavourably



THE MOST VARIABLE VARIABLES

1. Operational Demand
2. AWEFS/ASEFS forecast (all large-scale intermittent gens)
3. Aggregate of non-int. generator availability bids
   - Observed to significantly decline in hot weather

- Analyse the historical predictability of these variables as a group
  - By analysing regional surplus: 2 + 3 – 1 = “RXS”



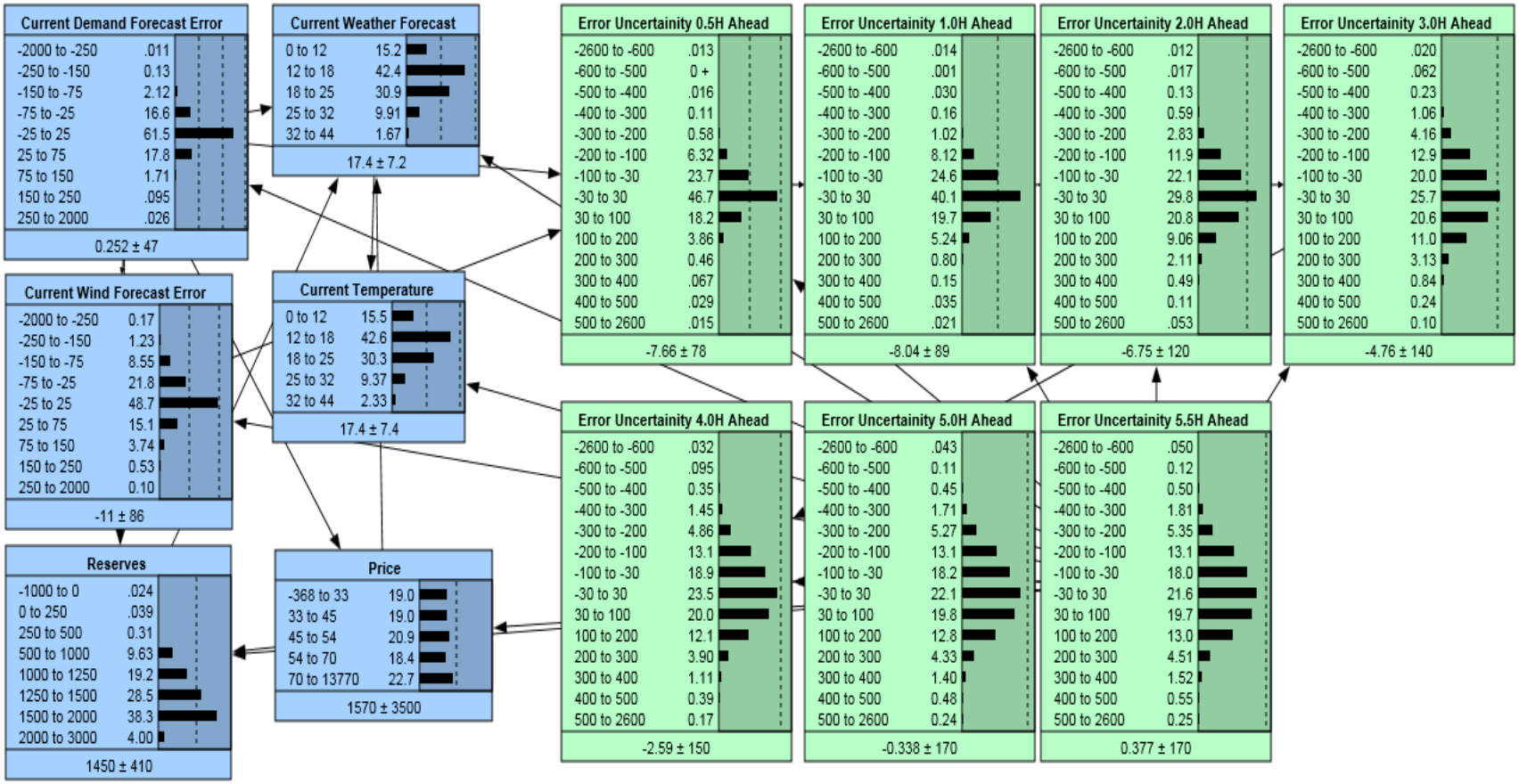
RXS FORECASTING ERROR

- Every half-hour in NEM history we have a record of at least 336 half hours of RXS forecasts for each region
  - Compare this to the actual RXS to get RXSerror
  - Truncate analysis to first 96 hours of forecast
  - Create a RXSerror distribution
- Identify an acceptable probability of unfavourable RXS error
  - So that, 6 hours out, LOR2 fails to forecast an actual load shed event no more often than about once in 10 years
  - Historical analysis suggests:
    - [96%] Probability of favourable exceedance is ~1 day in 10 years = Confidence Interval
    - Will increase LOR2 days <50% from existing

      [Note this interval continues to be studied and refined]

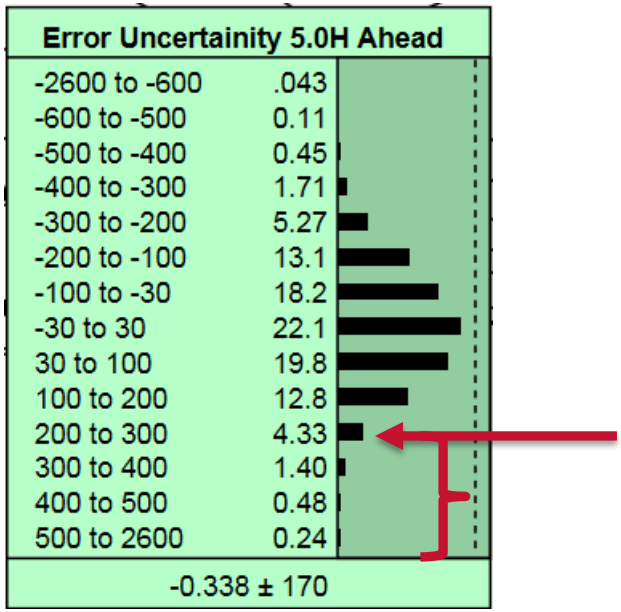
BAYESIAN BELIEF NETWORK

- From historical data, can determine how much RXS varies in relation to input states



INPUT STATES

- Many input conditions are known at the time of the forecast
- Those shown to be most significant are:
  - How far ahead the forecast is
  - Temperature forecast for the half hour being forecast
  - Wind forecast for the half hour being forecast
  - The demand forecast error at the present time



- Use these input states to determine the RXS distribution for the present conditions.
- FUM is the 4% tail.

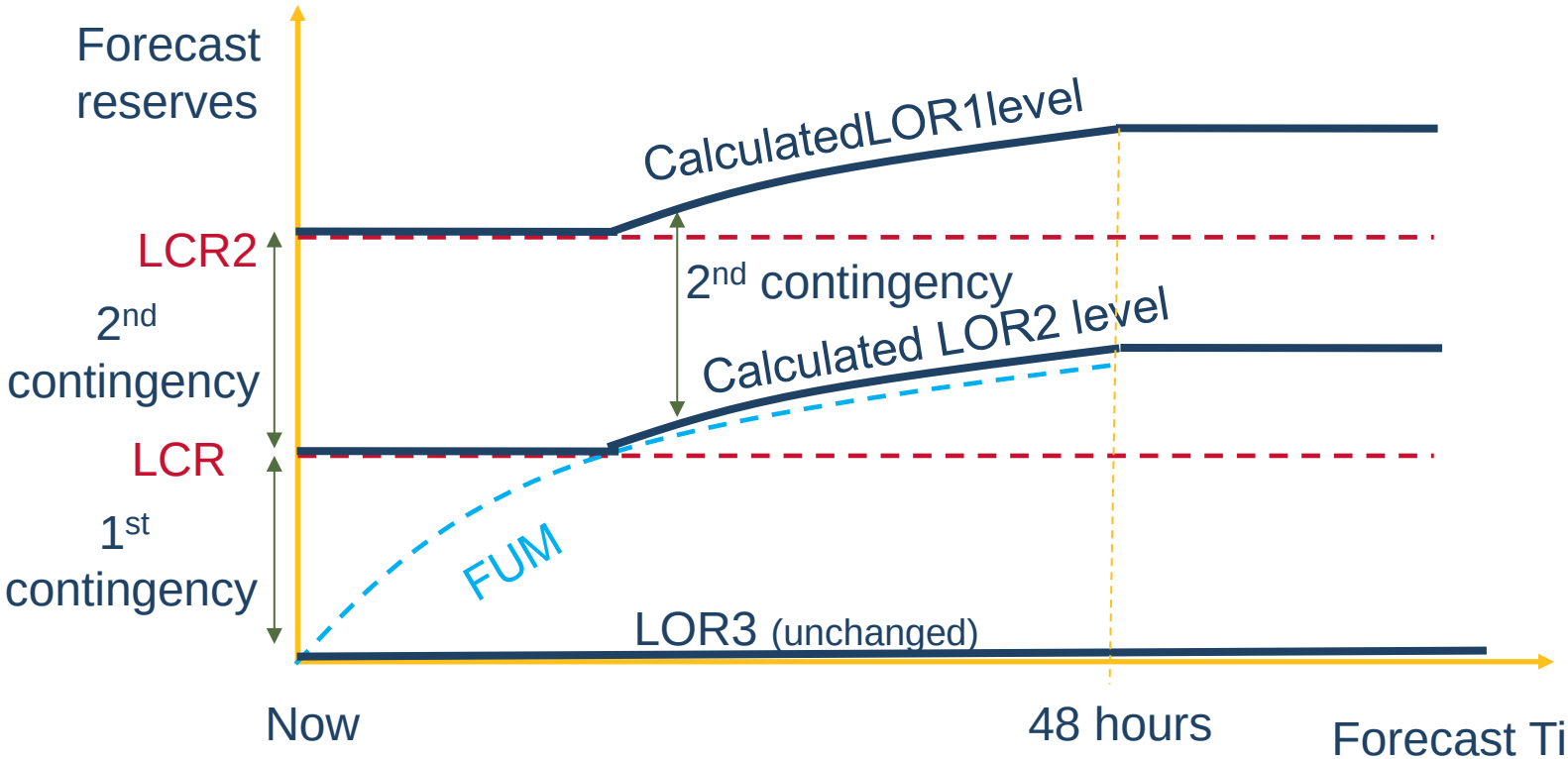
96% confidence interval = FUM
(Slide simplified – BBN uses 20 MW increments)

LCR (CONSIDERED CONTINGENCIES)

- Existing rules require considering largest generator risk, permits AEMO discretion on network contingencies
- AEMO has progressively considered some, but not all, network contingencies
  - Lines creating areas of concern:
    - E.g. Basslink, Heywood, windfarm collector lines
  - This has been manual and not transparent
- Project will formalise this:
  - Publish the list of considered network contingencies
  - Automate their inclusion in the system

PUBLICATIONS

- Unchanged from present
- Market notices when LOR condition reached
- PASA tables
  - o “CalculatedLOR1 level” and “CalculatedLOR2 level”
    - ➢ Instead of a fixed number, will be greater of LCR or FUM



THE GUIDELINES

- “LOR guidelines” will explain all the above, including:
  - RXS Definition and derivation of its distribution
  - Relevant input states
  - Confidence interval [96%] and FUM
  - Considered contingencies
  - Definitions for LOR3, 2, 1
  - Explanation of training the Bayesian Belief Network
  - Publications
- Future guidelines subject to a consultation process
  - V0.1 to be published 17 October on AEMO website
    - Submissions please

TIMEFRAMES

- Key 2017-18 Summer Readiness Project
  - AER report into 8/2/17 ➔ Finkel chapter 1
    - COAG/ESB expectation
- AEMO's project on track for 1 Dec completion
  - Offline trial till Rule made
- If Rule made 19 Dec 2017, will activate 9 Jan 2018
  - AEMC prioritisation made this possible – thanks!
  - Guidelines V0.1 published 17 October 2017
- Guidelines approach enables continuous improvement
  - We have described V1.0 design only. Future versions:
    - Network constraint forecast error
    - Changed input states list
    - Refined confidence interval

DISCUSSION