Peak RC's Real-time Tools

Saad Malik
Director of Engineering

PEAKRELIABILITY
assuring the wide area view

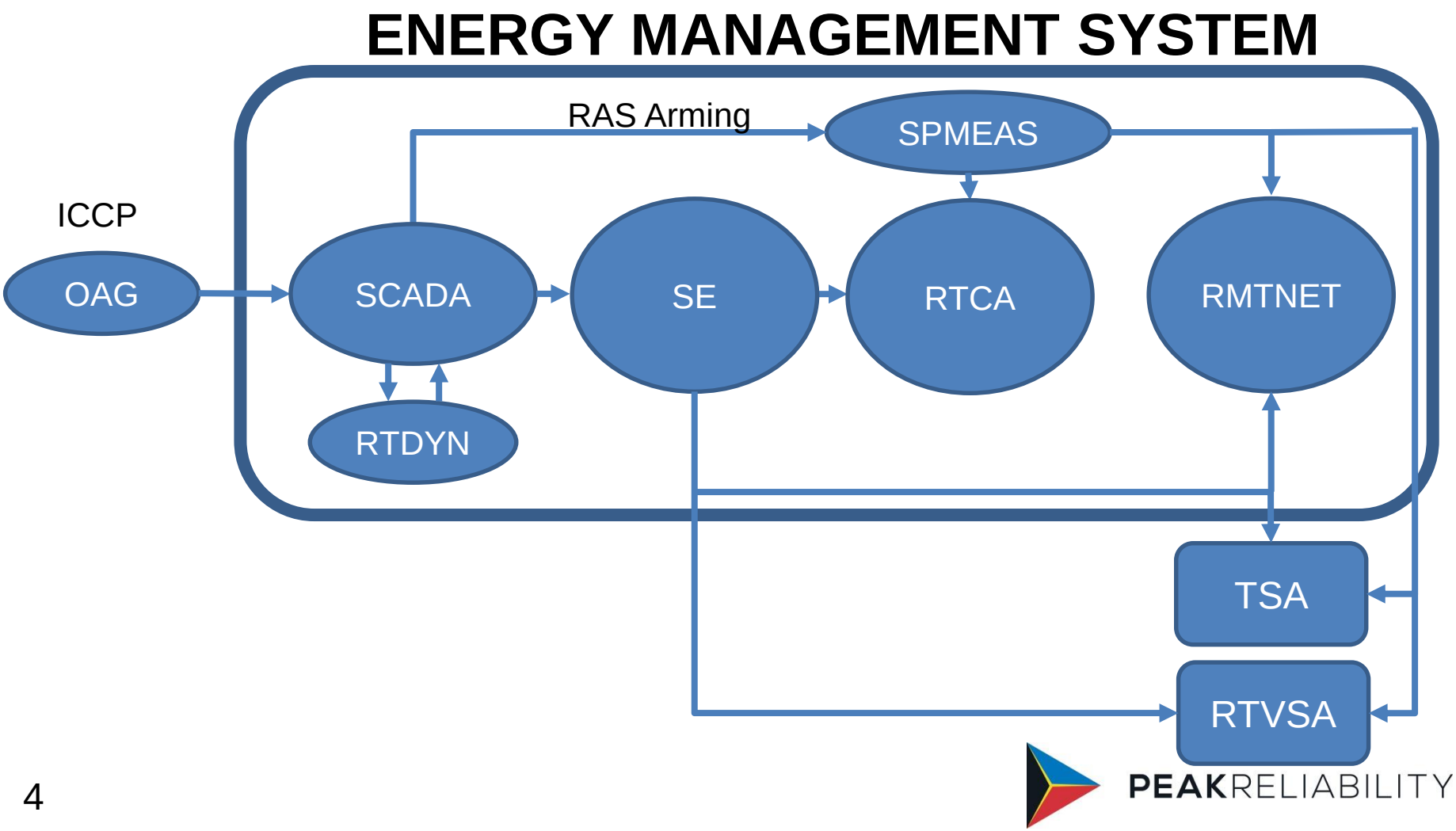
Focus on Real-time Tools

- System planning base-cases
- Changing system conditions
  - Loads
  - Generation patterns
  - Outages
- Situational awareness

Situational Awareness Tools

- EMS
  - SCADA
  - State Estimator (SE)
  - RTCA (Real-time Contingency Analysis)
    - NETSENS
  - RTVSA (Real-time Voltage Stability Analysis)
  - TSA (Transient Stability Analysis)
  - RMTNET (Real-time Multiple Timepoint Study)
  - RTDYN (Dynamic Facility Ratings)

Network Application Setup



PEAKRELIABILITY

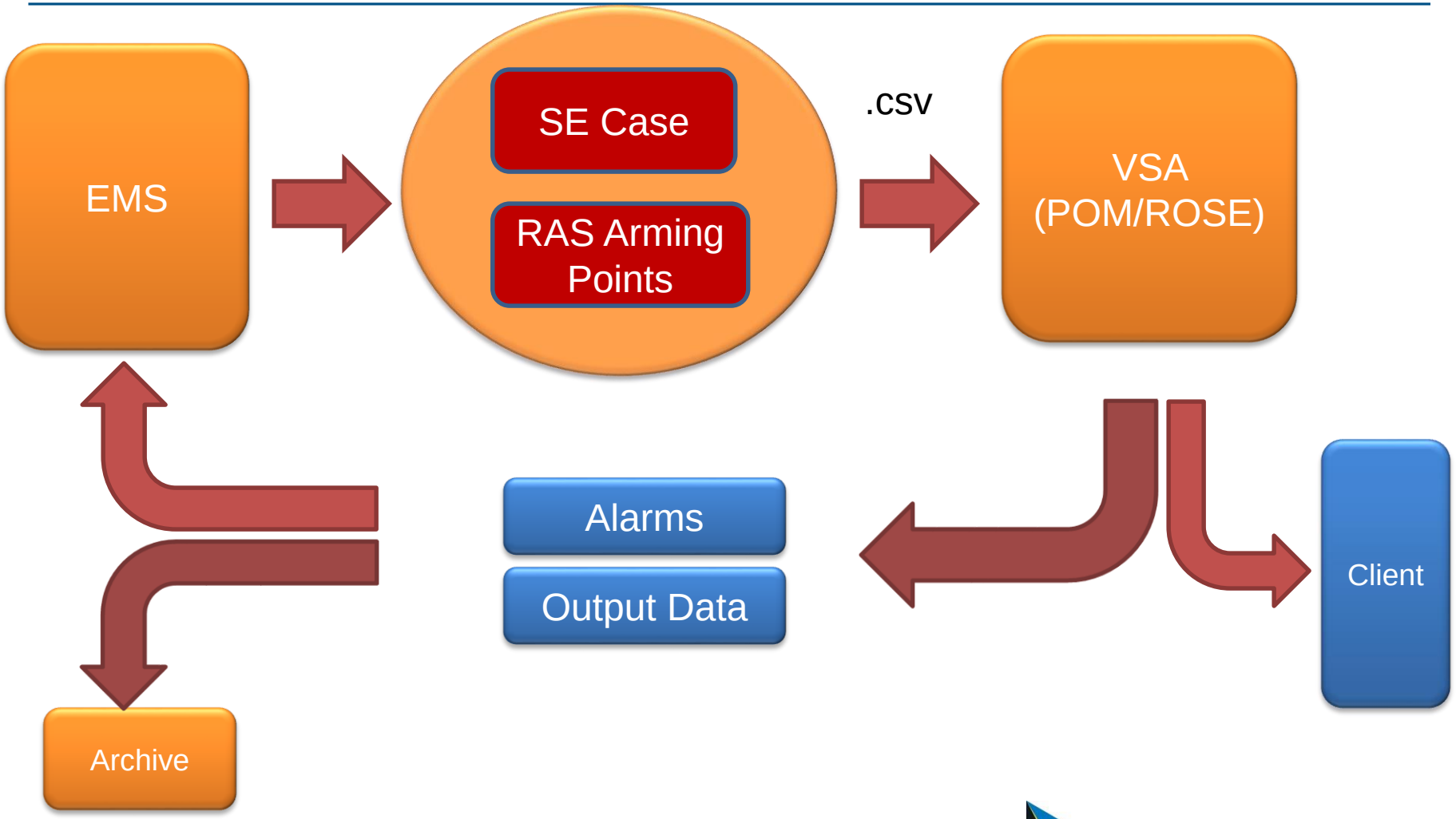
Real-time Voltage Stability Analysis

- Need for voltage stability analysis
- Load bubbles
  - Load area VAR limits
- Interface voltage collapse
  - Source VAR limitation
- Real-time Stability Limit

RTVSA Setup

- Transfer state estimator case (5 mins interval)
- Increase Transfers
- Identify Monitored Buses
- Apply Contingencies & RAS
- Stop transfer when case is unsolved
- Alarm Operator (when approaching instability)

RTVSA Tool



PEAKRELIABILITY

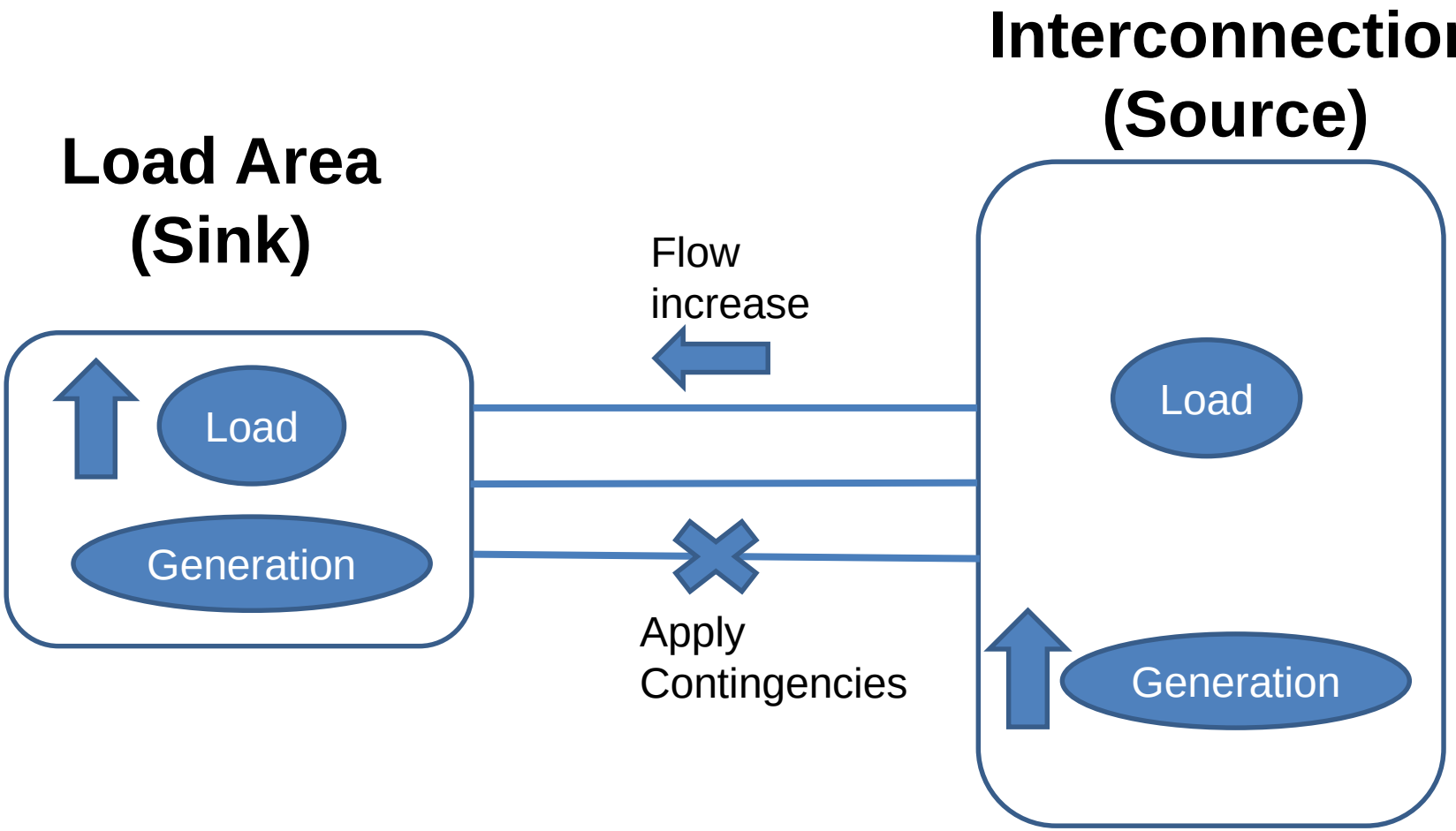
Modes of Operation

- Offline Mode
  - Operational Planning Analysis
  - Real-time Operations Support
- Real-time Mode
  - Utilizes SE case
  - Real-time RAS statuses
- Back-up offline tool

Inputs/Outputs

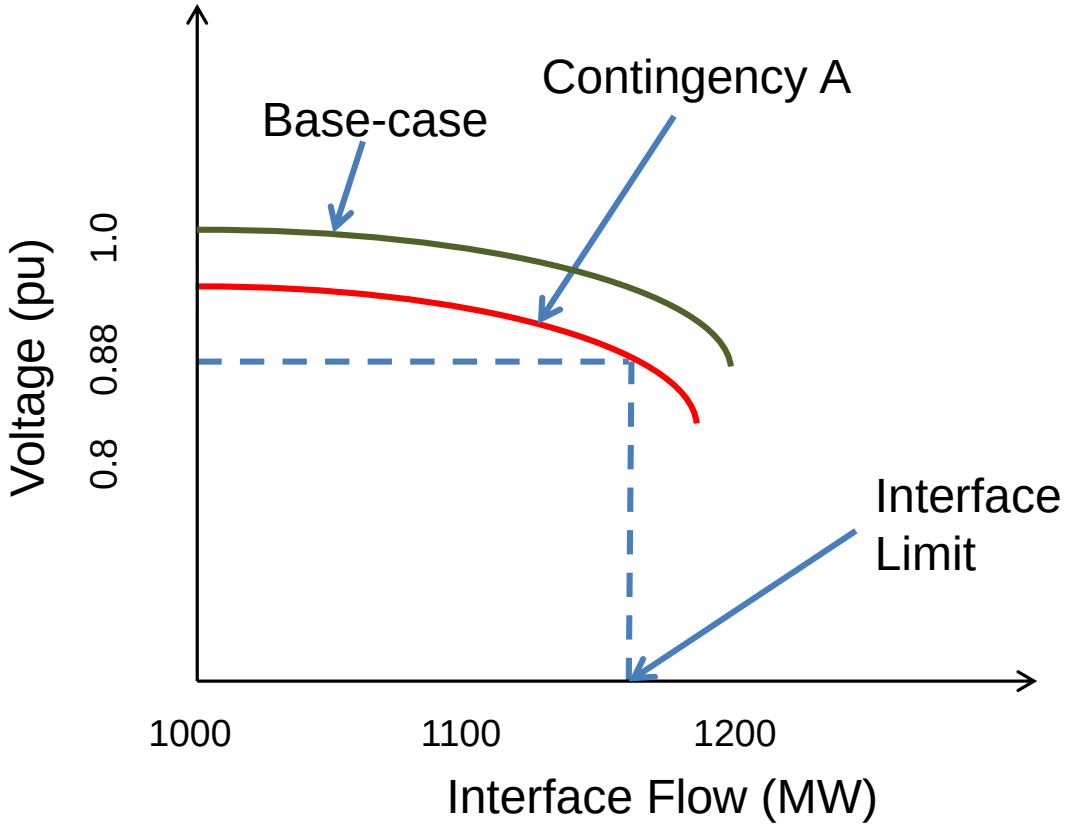
- Inputs
  - SE Case
  - RAS Arming Points
  - Transfer definition (source, sinks, contingencies etc.)
- Outputs
  - PV Curves
  - QV Curves
  - Interface Limits
  - Alarm Outputs

Calculation Methodology (Example)



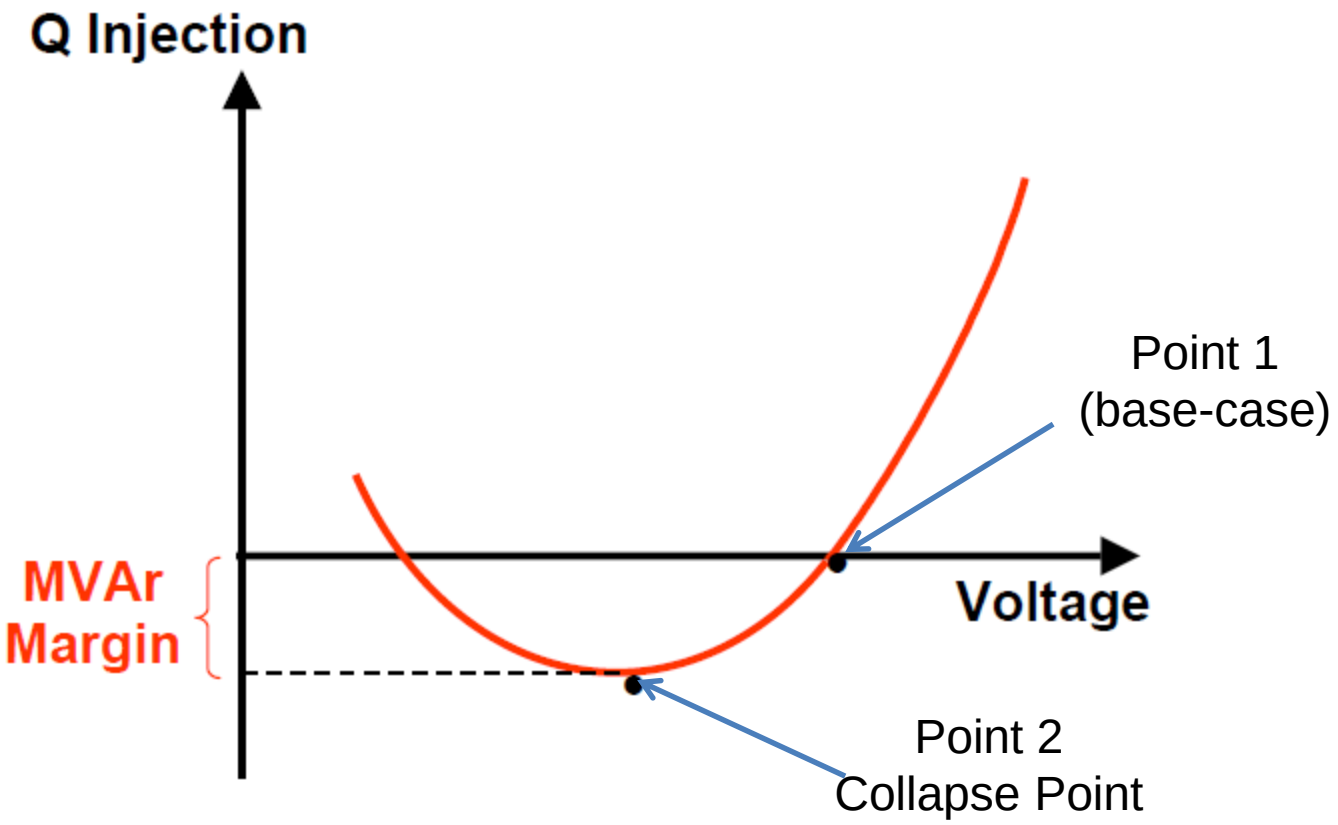
PEAKRELIABILITY

Limit Calculation (Example)



PEAKRELIABILITY

VAR Margin Analysis



PEAKRELIABILITY

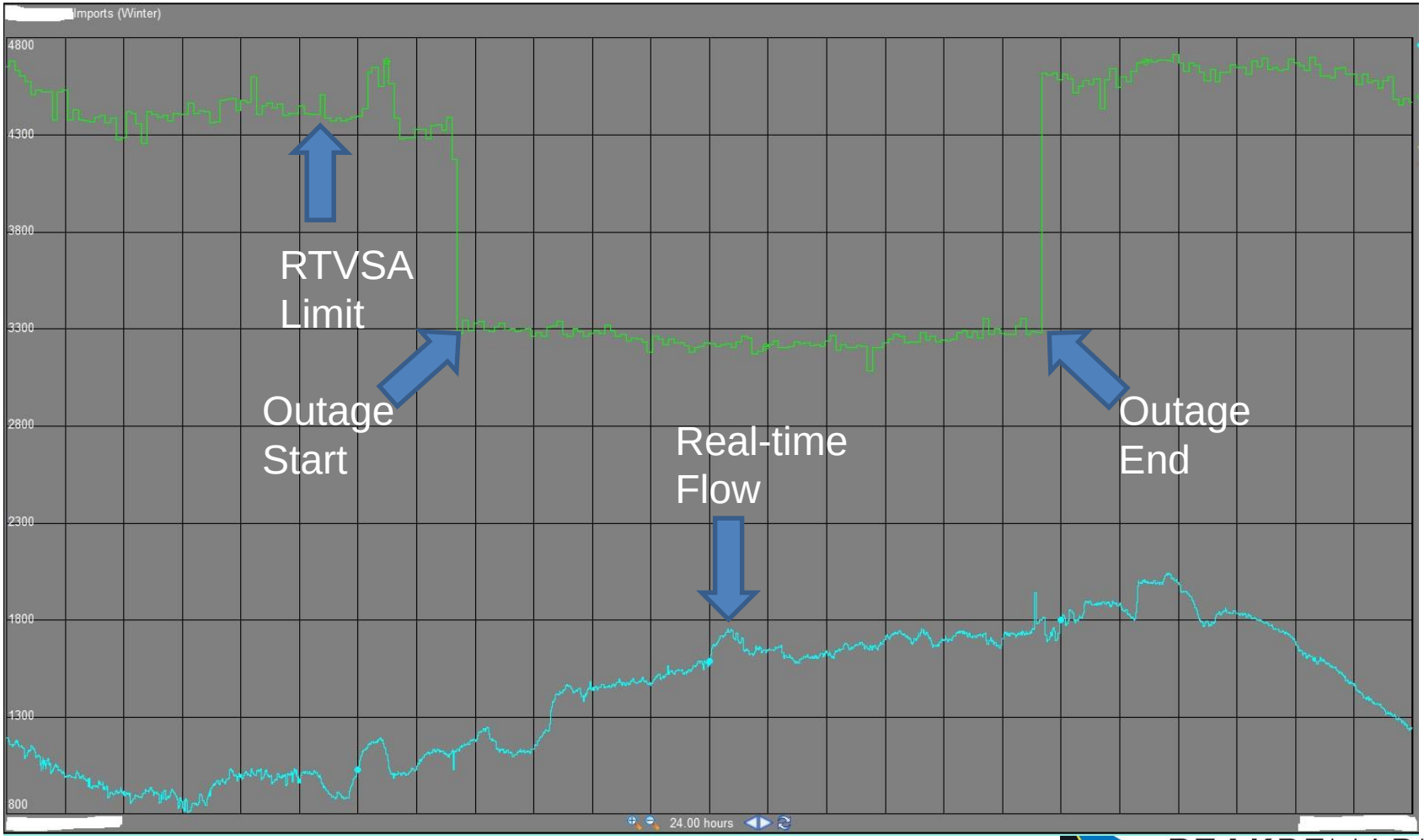
Key Assumptions

- Source
  - Base loaded units/renewables
  - Max MW output
- Sink
  - Non-conforming loads
  - Aggregate loads
- Interface definition

Key Assumptions (Contd.)

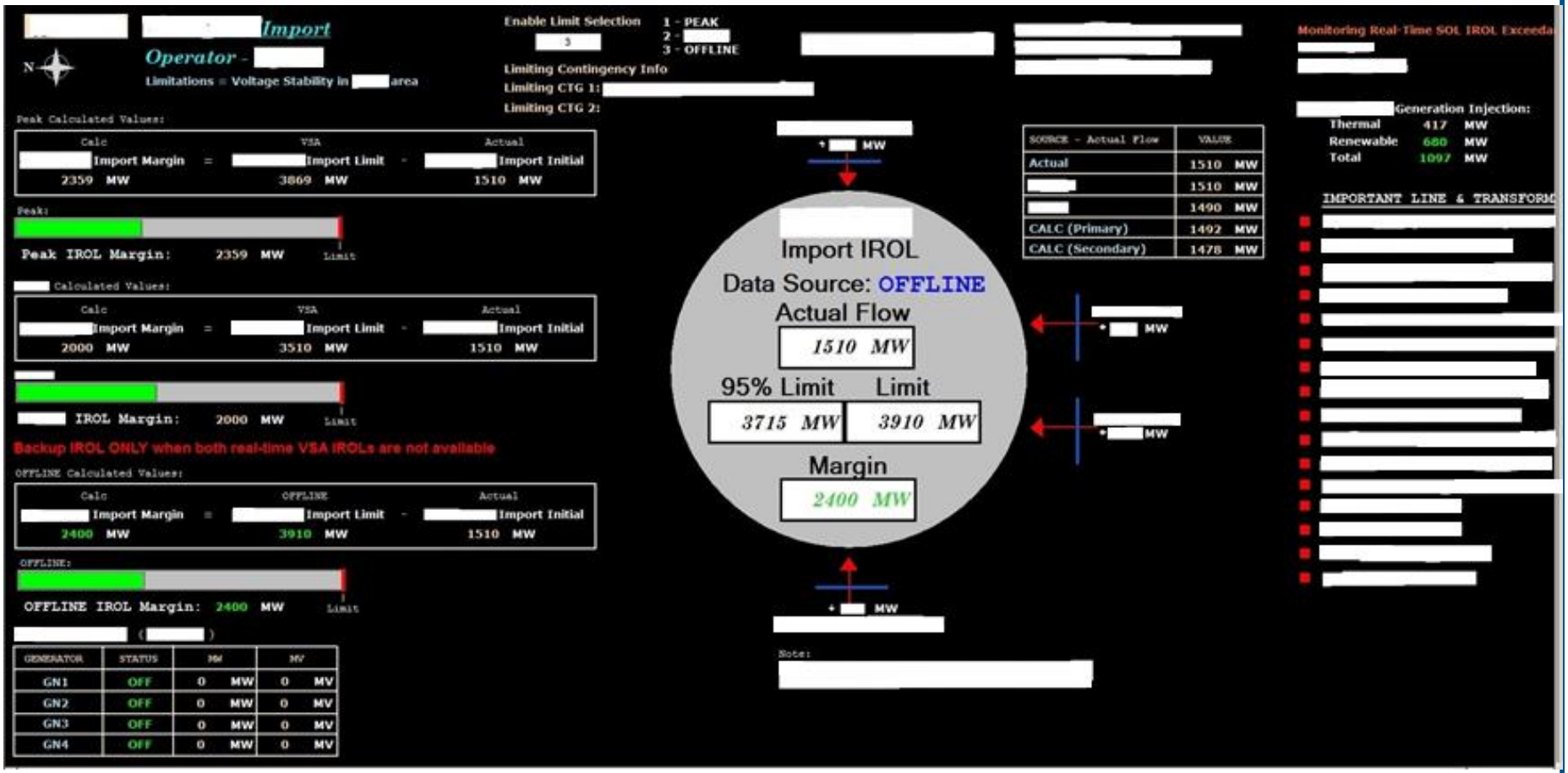
- Contingencies
- RAS modeling
  - Real-time arming status
- Shunt switching

RTVSA Limit (Example)



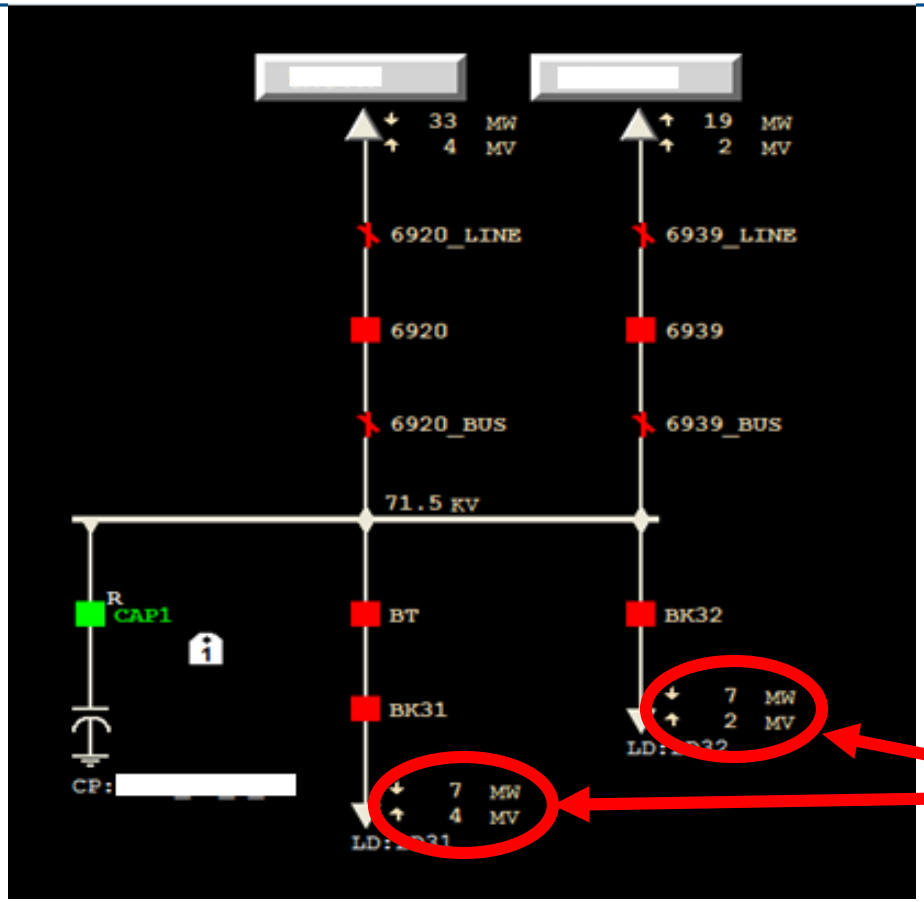
PEAKRELIABILITY

Monitoring of Results



PEAKRELIABILITY

Impact of Aggregate Loads



Negative VAR Loads (Aggregate Loads)

PEAKRELIABILITY

Implementation Considerations

- Accurate system modeling
  - Real-time measurements
- Clean SE cases
  - Real-time Engineers
- Back-up limit calc. process
- Training & procedures
- Continuous Improvement (event analysis)
- External entity coordination

Operating Procedure

- Day-ahead
  - Limit calculated and coordinated with TOPs
  - Implemented in Real-time as a starting point
- Real-time
  - Alarms generated off of RTVSA
  - Limit re-calculated (Offline VSA & Study VSA)
  - Operator action based on margins

Lessons Learned

- Reading full topology model was the right thing
- Applying RAS schemes was challenging
  - Real-time vs. Operations Planning
- Continual review and documentation of assumptions

Lessons Learned (Contd.)

- Output of the RTVSA tool considered as the limit automatically
- Importance of validation tools
  - Use of a different tool
  - Validation considerations
- Operating margins for validation and coordination

Future Considerations

- RAS Enhancements for OPA
- Automatic validation of RTVSA results
- Multi-dimensional Transfers

Questions

Saad M Malik
smalik@peakrc.com