Reliability Assessment Expected Unserved Energy (EUE)

Transmission Planning & Service

Introduction

Why Probabilistic Analysis?

- Many uncertainties
  - load level
  - operating status of generators
  - operating status of transmission lines and other system components
- In order to apply deterministic techniques and criteria,

  the system must be artificially constrained into a fixed set of values which have no uncertainty or variability (i.e., risk of outages)

- Deterministic analysis requires extensive study of credible events but no measure of risk can be determined

Expected Unserved Energy

- One way to overcome the restriction of deterministic approach
  - Expected Unserved Energy (EUE)
    - Measure of transmission system capability to continuously serve all loads at all delivery points while satisfying all planning criteria
    - Required information for computing EUE

      a. Frequency of each contingency (outage/year)

      b. Duration of each contingency (hr/outage)

      c. Unserved MW load for each contingency
    - EUE = sum of all the probabilistic weighted unserved MW for each contingency

Expected Unserved Energy

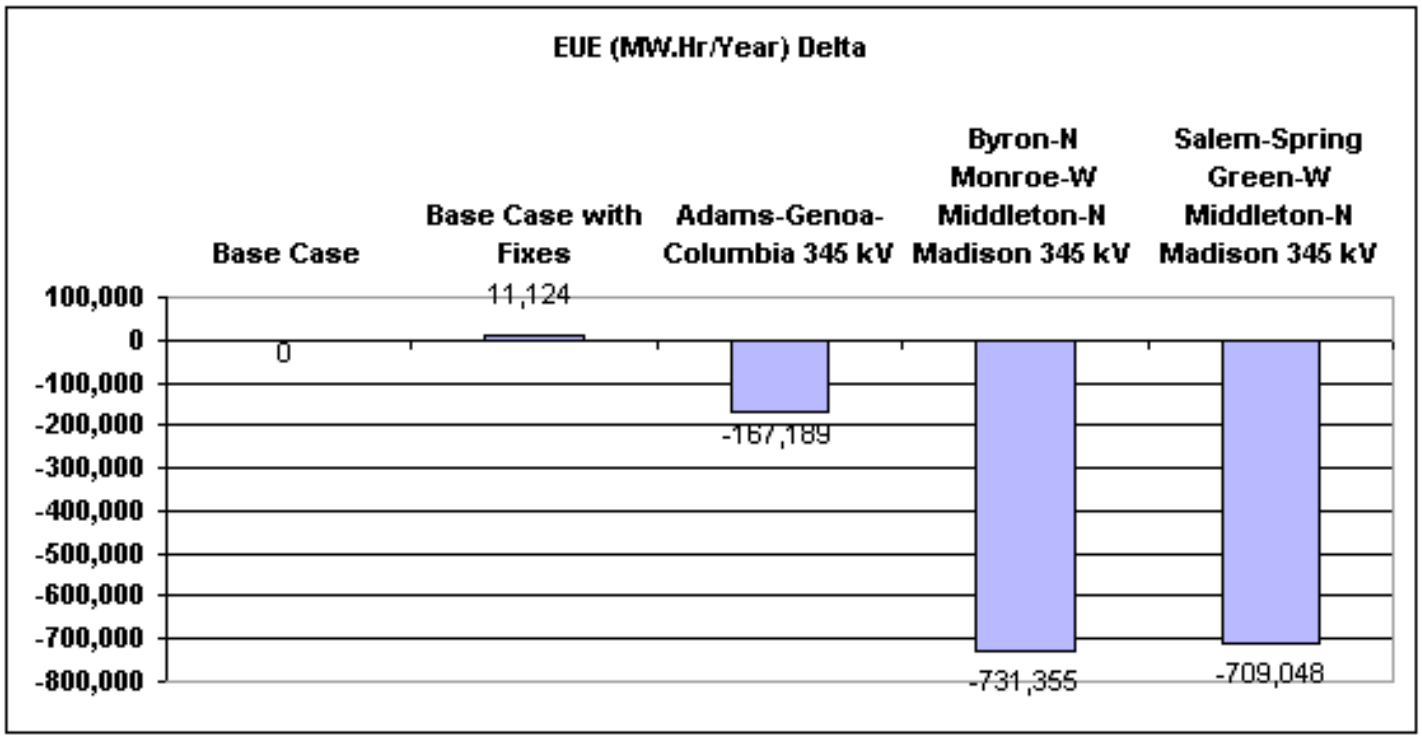
- Benefit of having EUE index
  - Likelihood of each contingency is considered
  - The impact of a system reinforcement can be quantified as a single summary measure
  - System-wide reliability can be assessed
  - Reliability merit of each system reinforcement can be measured
  - Reliability ranking or comparison of reinforcement alternatives can be done

Application

- Which Access Project provides the biggest benefit in terms of system reliability ?
  - Physical Operation Margin and Optimal Mitigation Measure (POM/OPM) software was used to compare
    - unserved MW load for each alternative
    - delta EUE measured relative to the Access Base model.
  - Line outage probabilities were derived from 1997-2003 actual outage performance by voltage class

EUE result for Each Access Project

Model	Unserved MW load (MW)		EUE (MW.Hr/Year)			
	Intact	N-1	Intact	N-1	Total	EUE Relative To Base Case
Base Case	575	3,229	1,193,765	28,259	1,222,024	0
Base Case with two fixes	583	3,318	1,204,884	28,265	1,233,149	11,124
Adams-Columbia 345 kV	501	2,946	1,034,290	20,545	1,054,836	-167,189
Byron-N Madison 345 kV	229	1,930	471,489	19,181	490,670	-731,355
Salem-N Madison 345 kV	238	2,132	493,278	19,698	512,976	-709,048



Conclusion

- The performance of the Byron-North Madison 345 kV line would result in significant reduction in EUE.
- Salem-North Madison 345 kV line - second best alternative and comparable to the Byron-North Madison 345 kV line.
- The impact of Adams-Columbia 345 kV line on EUE is insignificant.