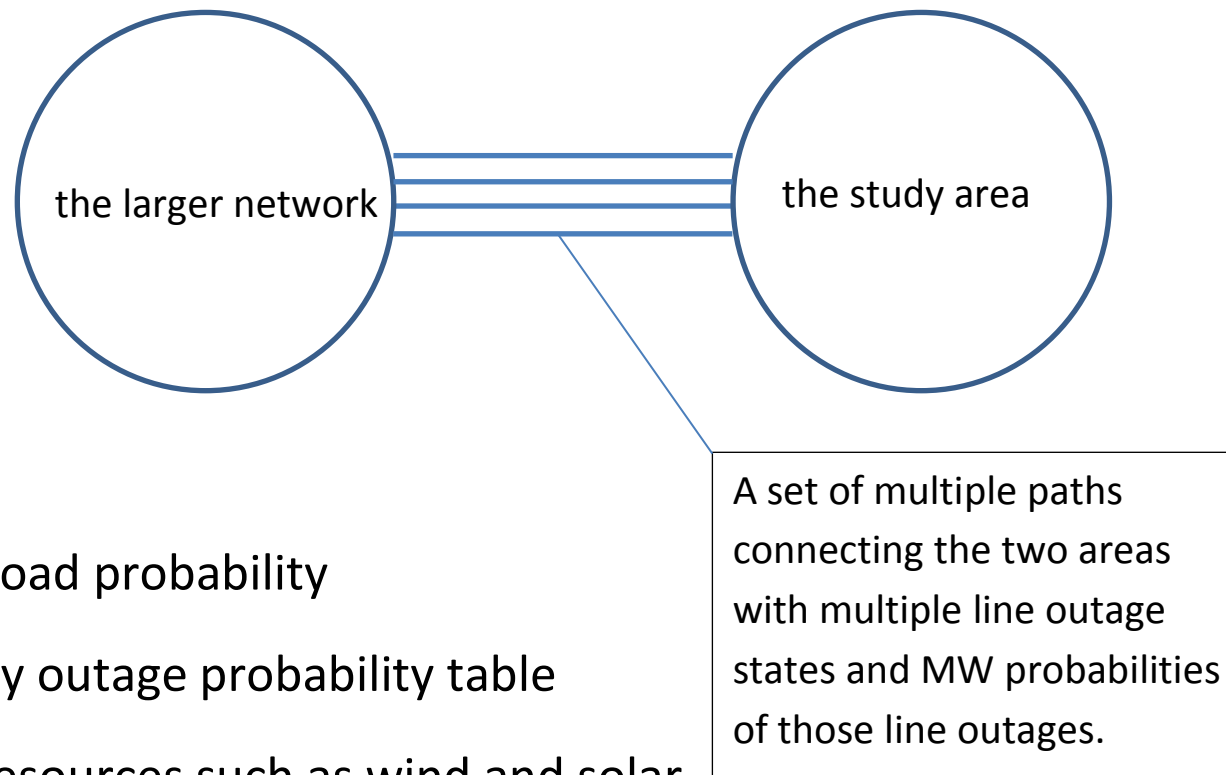


Probabilistic Transmission Planning Using ATC Analysis Combined With a Two Area LOLP Model

by Gene Preston <http://egpreston.com> August 2016

Two Area LOLP Model (hourly load, VR, and COPT generation in both areas):



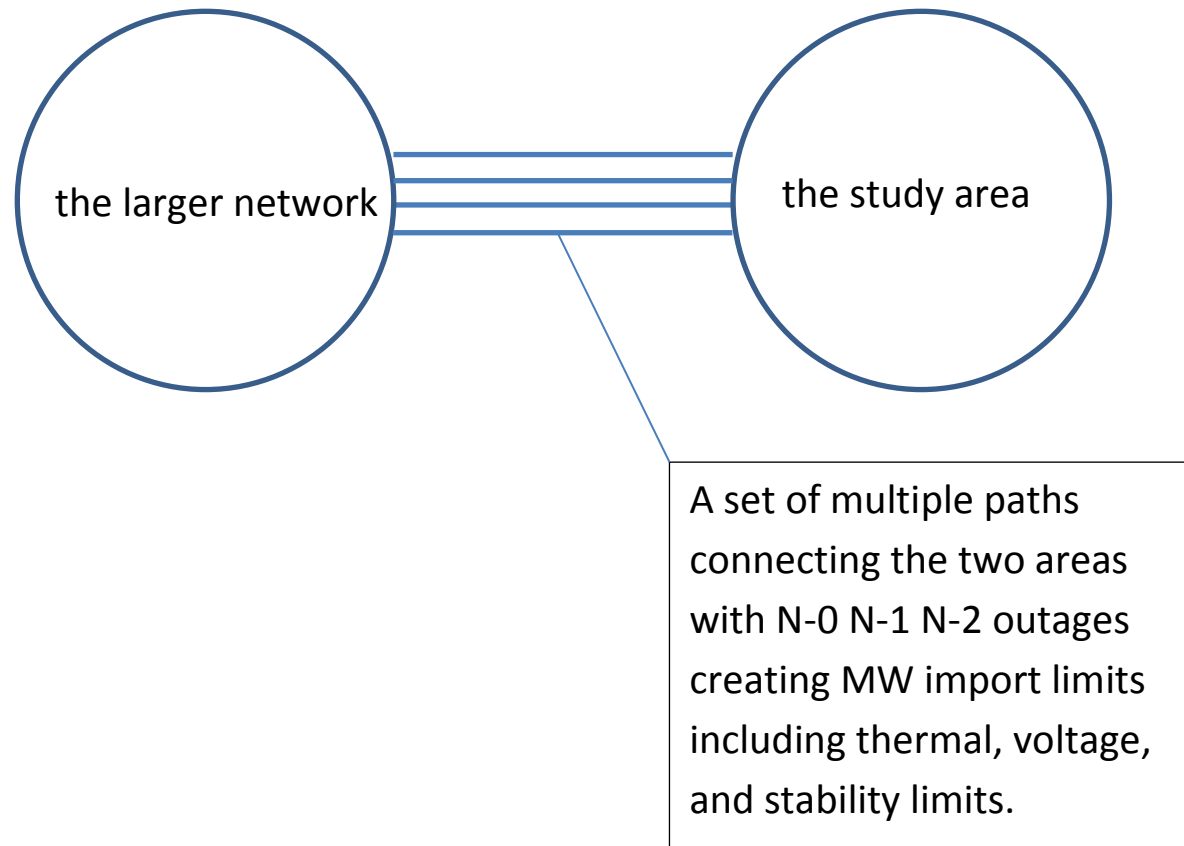
LOLP = loss of load probability

COPT = capacity outage probability table

VR = variable resources such as wind and solar

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Available Transfer Capability (ATC) detailed electrical analysis:



We can take advantage of the two model's similarities.

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Sample ATC output report for importing power into Austin, Texas:

2021 Summer Peak ATCs into Austin Energy, double auto outages included

Available Transfer Capability Summary:

New generation added to the base case = 1000 MW -----
 Number of lines outaged and monitored = 884 V

	-----from-----	-----to-----	ID	mi	ratg MVA	%-of-ratg 0-MW X-MW	dist fact	ATC MW
outage:	9074 LYTTON34 345	- 9075 LYTTON13 138	2					
outage:	9074 LYTTON34 345	- 9075 LYTTON13 138	1					
loads:	9075 LYTTON13 138	- 9074 LYTTON34 345	3	0	528	93 111	0.095	384 max
N-0:	24 mi from	9187 DECK_MB1 138			473	55 66	0.049	

N-1-1 ATC = 384 MW, probability = .04^2 = .0016?

outage:	3696 HUTTOSS_ 345	- 7042 L_ZORN__ 345	1					
outage:	3696 HUTTOSS_ 345	- 7340 L_GILLCR 345	1					
loads:	3696 HUTTOSS_ 345	- 3666 HUTTOSS1 138	1	0	750	88 105	0.130	711 max
N-0:	28 mi from	9187 DECK_MB1 138			700	54 66	0.073	

N-1 (ERCOT) ATC = 711 MW, probability of a common ROW 345 kV line

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Sample ATC output report for importing power into Austin, Texas:

```
outage: 9045 DUNLAP8 138 - 9190 TECHRIDG 138 1
loads: 9054 GILLE138 138 - 9195 NORTHEAS 138 1 2 710 78 107 0.200 764 max
N-0: 18 mi from 9187 DECK_MB1 138 640 59 82 0.136
```

N-1 ATC = 764 MW, probability of a single circuit 138 kV line 2 miles long.

normal:

```
loads: 9071 GARFIELD 138 - 9147 HICRSMB2 138 1 14 430 76 105 0.052 1677 max
N-0: 40 mi from 9187 DECK_MB1 138 430 76 105 0.052
```

N-0 ATC = 1677 MW, probability all limiting lines are in service.

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Steps in performing the two area LOLP study:

1. Identify the sending and receiving buses in the load flow.
2. Perform the ATC analysis going deep into the contingencies possibly up to N-3 using the line outage zipflow procedure on pages 123-128.
<http://www.egpreston.com/bookmod.pdf>
3. Sort the MW ATCs from lowest to highest.
4. Assign probabilities using TADS transmission forced outage rate data.
5. Determine the N-0 MW ATC level and a probability of no lines out.
6. Assemble all the transmission MW,Pr data for the LOLP analysis.
7. Perform the two area LOLP analysis.
8. Set up example programs to test the feasibility:
 - see MC2 – MC4i on web page: www.egpreston.com