Overview of AdCal Model

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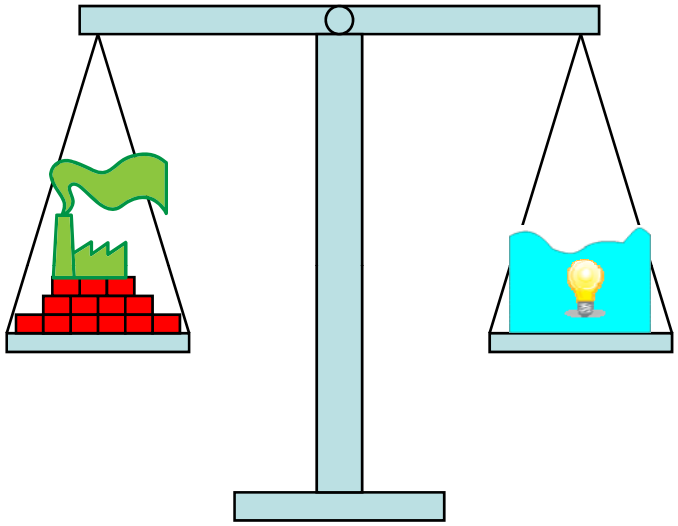
AdCal Overview

- Generation Adequacy Model (like CREEP)
- Weighs up supply against demand
- Calculates for each half hour of the year



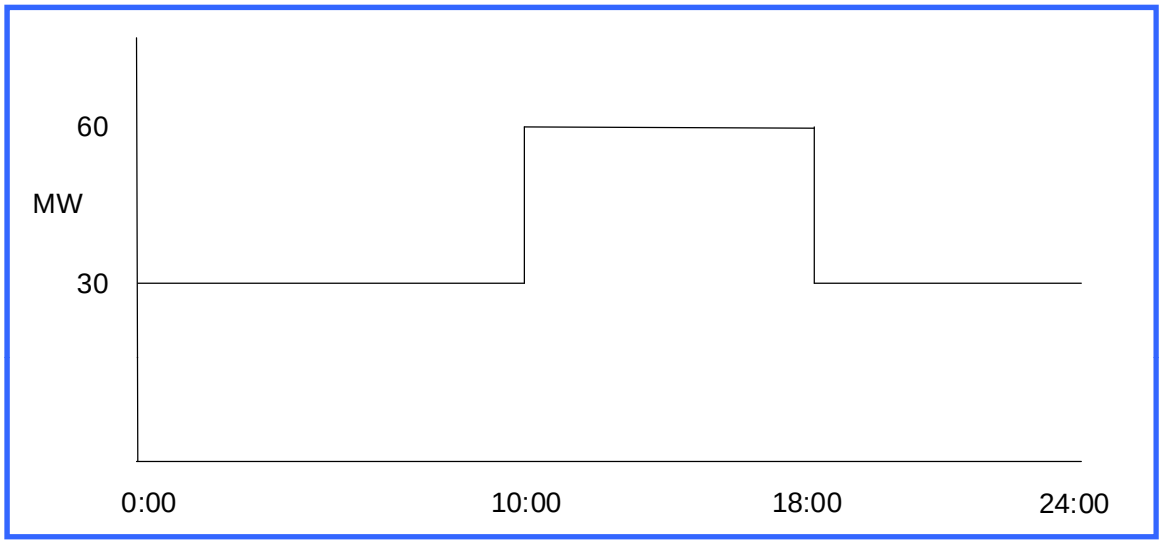
- Supply inputted as a list of generators, with capacities, FOPs, and SODs
- Demand inputted as yearly load curve

AdCal Overview

- FOPs give probabilistic element to generation
- AdCal determines the Loss of Load Expectation (LOLE)
- Calculates probability of demand exceeding supply for each half hour – Loss of Load Probability (LOLP)
- Sums for whole year

Sample LOLE calculation

Daily profile



3 Generators

Unit	Cap (MW)	FOP	Prob. of being available (1-FOP)
1	40	0.10	0.90
2	30	0.05	0.95
3	10	0.04	0.96

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Sample LOLE calculation

Unit 1 (40 MW)	Unit 2 (30 MW)	Unit 3 (10 MW)	Total Cap	Probability of each capacity	Cumulative Probability (LOLP)
0	0	0	0	0.10*0.05*0.04 = 0.0002	0.0002
0	0	1	10	0.10*0.05*0.96 = 0.0048	0.0050
0	1	0	30	0.10*0.95*0.04 = 0.0038	0.0088
0	1	1	40	0.10*0.95*0.96 = 0.0912	
1	0	0	40	0.90*0.05*0.04 = 0.0018	0.1018
1	0	1	50	0.90*0.05*0.96 = 0.0432	0.1450
1	1	0	70	0.90*0.95*0.04 = 0.0342	0.1792
1	1	1	80	0.90*0.95*0.96 = 0.8208	1.0000

- eg Prob. of Generation < 60 MW = 0.145
- LOLP summed for every half hour to give LOLE

Sample LOLE calculation

So for each half-hour:

- LOLP * 0.5 = LOLE contribution for this half-hour

- For our example day, only two load levels so

  At 30 MW: 0.0050 * 16 hours = 0.0800

  At 60 MW: 0.1450 * 8 hours = 1.1600

  LOLE for day = 1.2400 hours

Repeat for every day to get annual LOLE

AdCal – Perfect Plant

- Accepted standard is 8 hours LOLE per year
- AdCal calculates how much generation can be removed from system without breaching standard

- Surplus given in terms of Perfect Plant capacity
- Conventional generator with no outages

AdCal Demo

AdCal – Real Plant

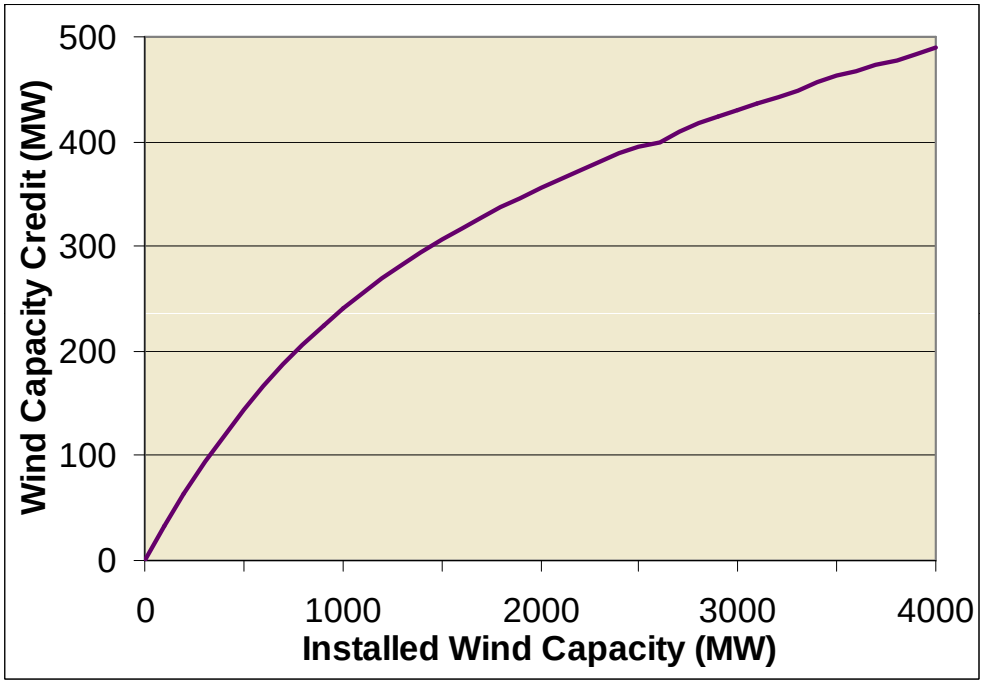
- Perfect Plant must be converted back to ‘real’ plant
- Use conversion factor called Real Plant Factor (RPF)
- Create ‘ReferencePlant’ with characteristics averaged from the whole portfolio
- Insert into list of generation, observe change in surplus
- RPF = ‘Reference Plant’ capacity ÷ change in surplus
- Surplus in terms of real plant can then be determined

AdCal – Wind

- Wind profile is created using historic normalised profile
- Divide generated output by installed capacity
- Historic normalised profile is then multiplied by projected 2010 capacity to create 2010 profile
- Wind profile is deducted off load profile
- This reduced profile is the load that must be met by all other generation

AdCal – Wind

- Capacity contribution of wind is determined by the Wind Capacity Credit Curve (WCC)
- Curve taken from previous GAR



- Remove a series of scaled up wind profiles from the load and observe change in Surplus

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Final Calculation

Plant Capacity + Wind Capacity – Surplus

= Capacity requirement

- Time Weighted Capacity of conventional plant is calculated
- Wind Capacity Credit is added to this to give total capacity of system
- Surplus is multiplied by RPF to give real plant Surplus
- Real plant surplus is deducted from Total Capacity of System to give Capacity Requirement

Final Calculation

Total Capacity for Conventional:	9593
Time-Weighted Capacity for Conventional:	**9206**
Time-Weighted Capacity for Wind:	1999
Time-Weighted Capacity for Market Wind:	1514
Wind Capacity Credit	**269**
Capacity of Reference Plant	124
SOD of Reference Plant	3
FOP of Reference Plant	4.23
Surplus Generation	2450
Surplus Generation with Reference Plant	2565
Capacity Credit of Ref Plant	115
Percentage Capacity Credit of Ref Plant	92.50%
Surplus in Real Plant Terms	**2649**
Capacity Requirement	**6826**

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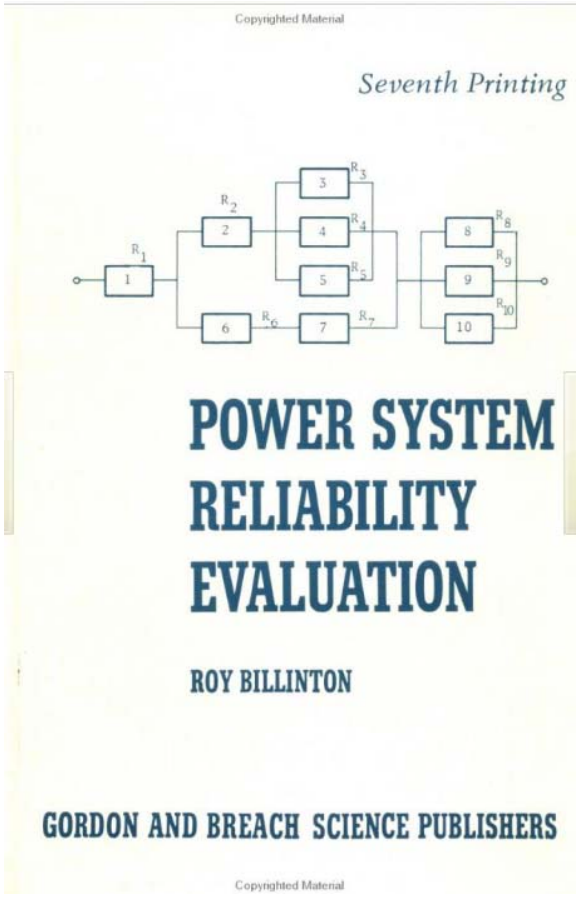
AdCal

Theory based on

“Power System Reliability Evaluation”, Roy Billington

First Edition 1970



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