Optimal Allocation of Wind Generation Subject to Voltage Stability Constraints

Mostafa Bakhtvar (Mostafa.Bakhtvar@ucdconnect.ie), **Andrew Keane** (Andrew.Keane@ucd.ie),
University College Dublin, School of Electrical, Electronic and Communications Engineering

Introduction

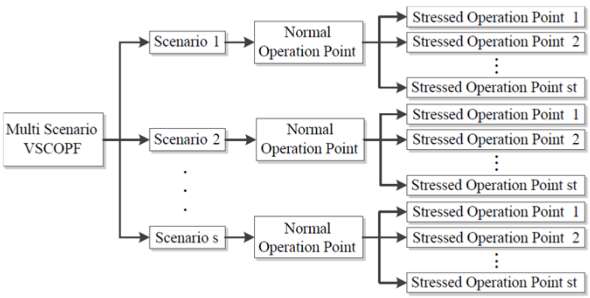
- High instantaneous wind penetration: 50% - 60% - 70% …
- Occasionally operating points close to technical and physical limits e.g. voltage stability
- Costly remedies: load shedding and network reinforcement
- Well chosen allocation of wind capacity

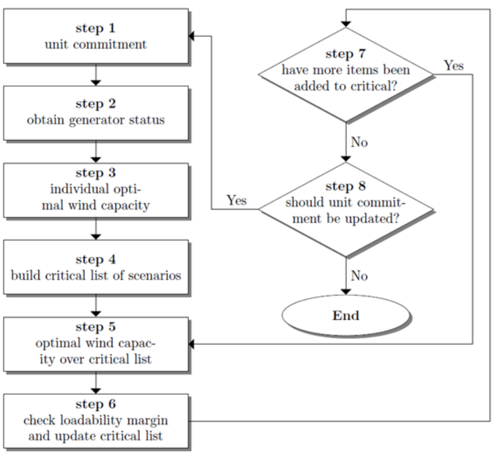
Objective(s):

- Enhance Voltage Stability

Methodology

- Two set of variables
- Multiple wind and demand levels
- Voltage stability index: loadability margin
- Voltage Stability Constrained Optimal Power Flow
- Unit Commitment fed in VSCOPF iteratively
- Maximize the minimum loadability margin





Test System

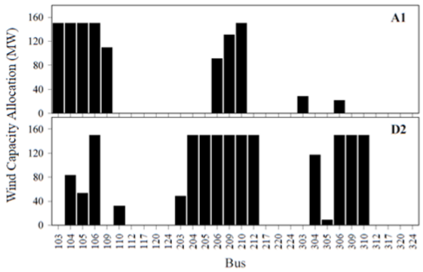
- IEEE 73 Bus
- 30 candidate buses for wind capacity allocation
- 80 wind-demand scenarios

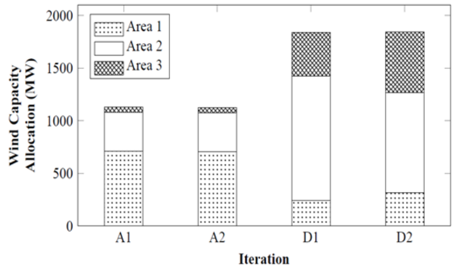
Results

- Minimum loadability margin in firts and last iterations

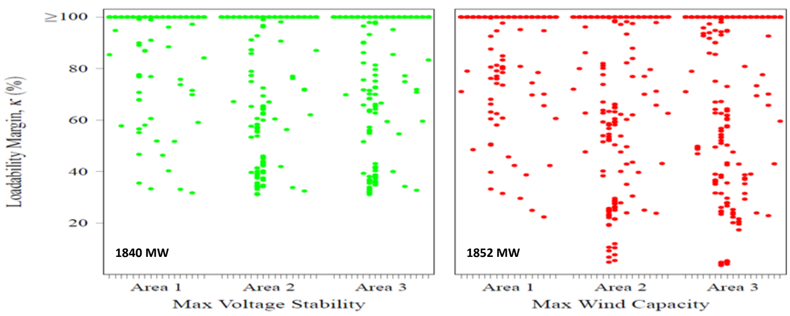
Unit Commitment Iteration	Wind Capacity Allocation Iteration	Number of Items in Critical List	Minimum Loadability Margin, κ (%)
A	1	80	38.34
	2	84	30
D	1	80	34.33
	2	126	31.08

- Pattern of wind capacity allocation (MW)

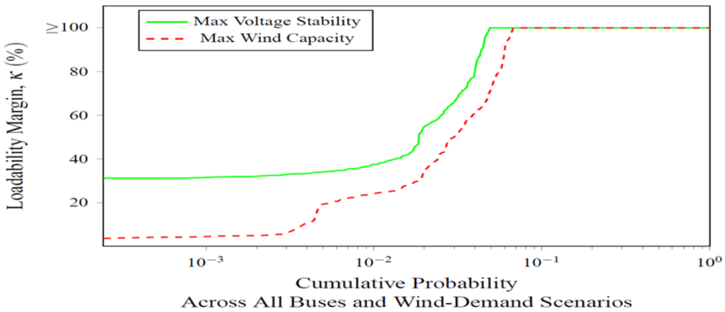




- Test system loadability margin



- Cumulative probability of loadability margin across all buses and wind-demand scenarios.



Conclusions

- **The pattern of wind capacity allocation affects both the voltage stability and the total wind capacity allocated in the system**
- **Wind capacity allocation to certain buses in the system may increase voltage stability margin**
- **A well chosen wind capacity allocation has the potential for improving voltage stability margin.**

Acknowledgement

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