

Take My Grid, Please!
A Primer on Bulk Electric Power Systems

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1. Introduction

- Arrangements
- What is a “law” – the Laws of Physics
- Physics vs. Economics
- Battle of the Currents – DC vs. AC
- Why did AC win?

2. Some Fundamentals

- Power & Energy
- Kirchhoff’s Laws
- What makes power flow?
- Power system stability
- Reactive power (VARs)
- Reliability – can you pay for what you need?

3. Interconnected Networks – Grids

- Why “interconnect”?
- Characteristics of a synchronous interconnection
- The four North American grids
- Common analogies – and why they’re wrong
- Control Areas – a.k.a. Balancing Authorities
- Reliability Standards vs. Criteria
- Should reliability standards be uniform?

4. Transmission Transfer Capabilities (TTCs)

- What’s a “contingency”?
- First Contingency Design – the “Prime Directive”
- Typical requirements for planning & operations
- Transmission constraints
- Parallel path flow
- The per unit system
- How TTCs are calculated – examples
- Determining what a TTC should be
- How to increase transfer capabilities

5. Balancing Act: Reliability & Commercial Use

The Six Sigma standard: applied to power systems
Can the market provide reliability?
NERC and its role
Mandatory conformance
An example: NERC Standard TPL-002
New paradigms & misapplications

6. Are the Present Grids too big? A Physics Solution

Smaller interconnections and HVDC ties
Advantages
Comparative costs
Typical objections – and answers
How large should they be?
References

7. The Great Blackouts

We learn from our mistakes
1965 Northeast
1967 PJM
1977 New York City
1996 Western Interconnection (twice)
9/11 New York City
2003 Midwest/Northeast
2006 & 2007 Astoria
Impacts, common elements, and lessons to be learned
Power system education

8. “Things to Come”

Myths about the grid
Proposed reliability fixes
The Energy Policy Act of 2005
National Interest Electric Transmission Corridors
The ERO & reliability standards
NERC’s standards development process

9. Conclusions / Lagniappe

Concerns about the future
“If you only remember one thing....”
References
Six ways to tell a real expert (from a fake one)