GOVERNMENT OF INDI1A
MINISTRY OF POWER
CENTRAL ELECTRICITY AUTHORITY
SEWA BHAWAN, R.K.PURAM
NEW DELHI-110066
Website: www.cea.nic.in

(आई.एस.ओ. 9001:2008)

No. CEA/ NRC/RA 2014

Dated 03.06.2014

To

As per list attached

Subject: **Minutes of 2nd Meeting of the National Reliability Council for Electricity (NRCE) held on 26.05.2014 at CEA, New Delhi**

Kindly find attached herewith the minutes of meeting of the 2nd Meeting of the National Reliability Council for Electricity held on 26.05.2014 at CEA, New Delhi, for information and necessary action.

P. Batra 3/6/2014

(Pankaj Batra)
Chief Engineer (I/C)
RA Division &
Member Secretary of the
National Reliability Council for Electricity

To

1. Member (GO&D), CEA

2. Shri Y.K. Sehgal, Chief Operating Officer (CTU), Power Grid Corporation of India Ltd. Saudamini, Plot No. 2, Sector -29, Gurgaon- 122 001, Haryana E-mail: powergridindia.com, Tel No: 0124-2571700, 0124-2571809

3. Shri P.S. Mhaske, Member Secretary of NRPC, 18-A, Shaheed Jeet Singh Marg, New Delhi- 110 016, Fax No: 011- 26865206, 26511211, 26526361, E-mail: msnrpc1@yahoo.com

4. Shri S.R. Bhatt, Member Secretary of SRPC, 29 Race Course Cross Road, Near Anand Rao Circle, Bangalore- 560009, Fax No: 080-22259343., 080-22287205, 080-22287205, E-mail; mssrpc@yahoo.com

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6. Shri A.K. Bandyopadhyay, Member Secretary of ERPC, 14 Golf Club Road, Tollygunge, Kolkata- 700 033, Fax No: 033-24171358, 033-2423-5016, E-mail: ereb_com@rediffmail.com, ereb_cea@yahoo.co.in,

7. Shri S.K. Ray Mohapatra, Member Secretary of NERPC, Meghalaya State Housing Finance Co-operative Society Ltd. Building, Nongrim Hills, Shillong – 793003, Fax No: 0364-2520030, 0364-2520034, E-mail: skrmohapatra@rediffmail.com

8. Shri K. Viswanathan, Director (Operations), TANTRANSCO, Maaligai, 144, Anna Salai, Chennai- 600 002 Telefax No: 044- 28521088, E-mail: diropn@tnebnet.org

9. Shri Manas Bandyopadhyay, Director (Operations), West Bengal State Electricity Transmission Co. Ltd, (WBSETCL), Vidyut Bhavan, Bidhannagar,Block - DJ, Sector - II,Kolkata - 700 091, Fax No : 033-23345962, E- mail: 1manasbanerjee@gmail.com

10. Shri Omprakash. K. Yempal, Director (Operations), MSETCL MAHARASHTRA STATE ELECTRICITY TRANSMISSION CO. LTD. PRAKASHGANGA, PLOT NO.C-19 , E-BLOCK, BANDRA-KURLA COMPLEX, BANDRA (E), MUMBAI – 400051, Tel No: 022-26595403, Fax No: 022-26590383, E-mail: dirop@mahatransco.in

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15. Chief Engineer (GM), CEA.

16. Chief Engineer (SP&PA), CEA.

Copy for kind information to:-

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2. Shri Devendra Chaudhry, Additional Secretary, Ministry of Power, E-mail: dch-mop@nic.in.

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5. Shri S. Akshayakumar, Director/Transmission, TANTRANSCO, NPKRR Maaligai, 144, Anna Salai, Chennai- 600 002 (Fax No: 044-28544528) TEL NO: 044-28521300

6. Shri SUSANTA KUMAR DAS, MANAGING DIRECTOR, West Bengal State Electricity Transmission Co. Ltd, (WBSETCL), Vidyut Bhavan, Bidhannagar, Block - DJ, Sector - II, Kolkata - 700 091, Fax No : 033-23370206, E- mail: susanta.das@wbsetcl.in

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Minutes of 2nd Meeting of the National Reliability Council for Electricity held on 26.05.2014 at CEA, New Delhi

The 2nd Meeting of the **National Reliability Council for Electricity** (NRCE) was held on 26.05.2014 at 11.00 AM in the Committee Room of CEA in the 2nd Floor. The list of participants is at Annexure-I.

2. Member (I/C), (GO&D), CEA and the Chairperson of the NRCE, Shri P.K. Pahwa, welcomed all members of the Council to the second meeting of the NRCE. He stated that in accordance with the decisions taken in the last meeting of the NRCE, a sub-group of the NRCE has been constituted to carry out examination of the System Studies for the purpose of calculation of Total Transfer Capability (TTC), Available Transfer Capability (ATC) and Transmission Reliability Margin (TRM) on a monthly basis. The sub-group held its first meeting on 23.05.2014 at NRPC, New Delhi. He then asked the Member Secretary of the NRCE to make a presentation on the findings of the sub-group.

3. Member Secretary, NRCE gave a brief background of the sub-group. He stated that the sub-group has been formed with Members as decided in the last meeting of the NRCE. In addition, two new members have also been nominated to the sub-group, as decided by the Chairperson of the NRCE. One of these members is Mr. D.K. Srivastava, Director, GM Division, CEA, who was also involved with the Grid Disturbance Committee which investigated the major grid disturbance of July 2012 in the Northern Region and was also a member of the Task Force on Power System Analysis under Contingencies chaired by ex-member (Power System), CEA. The second member is Mr.Pankaj Batra, Member Secretary of the NRCE. It was also decided by Chairperson NRCE that Member Secretary of the NRCE would be the Chairperson of the sub-group and Shri Srivastava would be the Convenor of the Sub-group.

4. Member Secretary, NRCE then made the presentation. He stated that a time schedule had been set for POSOCO to conduct the system studies of all inter-

regional/control area corridors for determination of TTC, ATC and TRM between 10th and 20th of each month for the next month. The sub-group would then check the data, the results of the system studies and the calculations for determination of TTC, ATC and TRM by 25th of the month and the same would be approved by the NRCE by the 27th of the month, so that the same is put up by the NLDC on their web-site by 28th of the month. In case of any doubts/clarifications the NRCE or its sub-group would consult POSOCO, and if some discrepancy/ shortcoming is found, the same would be informed to POSOCO for rectification.

5. However, for the month of June 2014, the studies for the last corridor were finalised and submitted by POSOCO to the sub-group only by 22nd May 2014 and the sub-group therefore did not have the time to examine the studies. They were therefore, not in a position to certify the TTC, ATC and TRM for June 2014. During the meeting of the sub-group on 23.05.2014, POSOCO stated that they would change the time lines of their internal processes to stick to the time line given by NRCE. Also, it was decided by the sub-group that before certifying the TTC, ATC and TRM, it is important to ensure that the methodology of calculation of the same is in order.

6. Member Secretary, NRCE stated that the methodology and modalities of determination of TTC, ATC and TRM were discussed in detail with POSOCO. The points raised by the sub-group were shown in the presentation. These related to the following issues :

- The methodology of getting the base case for the study, and whether the peak and the off-peak scenarios were considered.
- Whether any other scenarios, other than peak and off-peak, need to be considered.
- The methodology of calculating TTC,ATC and TRM.
- What were the constraints considered?
- Loop flows in determination of TTC, ATC and TRM.
- TTC, ATC and TRM between WR and NR, ER and SR.
- System Protection Scheme (SPS) setting on 765 KV Agra-Gwalior line.

7. Discussions then took place among the members of the NRCE on these issues. It was decided that it is important for the methodology to be examined and certified by the NRCE before the calculations of TTC, ATC and TRM are certified. It was decided that the sub-group along with any members of NRCE, if they so desired, would sit in NLDC and interact with them to find out the same, sometime between 10th and 15th of June 2014.

8. Member Secretary also pointed out that, in view of transmission constraints in certain corridors, either due to transmission lines or generating units not coming up in time, the transmission system should be used to the most optimum extent, without endangering grid security. In this respect, certain margins are available during operation due to the ambient temperature being lower than the norm considered for loadability of the transmission lines. For example, the ambient temperature considered generally is 40^0 C or 45^0 C. However, in winter temperatures all-over India are generally much below this, especially in the colder regions. This would result in higher loadability during winter as compared to summer, on account of thermal limits. Similarly, there is a difference between day and night temperature, leading to more loadability during the night, on account of thermal limits. POSOCO may consider the same for operational purposes. In this connection, Member Secretary stated that a presentation obtained from the Federal Electricity Regulatory Commission (FERC) website would be mailed to all the members, explaining the same. The NRCE could issue some norms on the same. A copy of the same is enclosed at Annexure-II.

9. Member Secretary then give the status of the follow-up action of the decision taken in the last meeting of the NRCE to explore the possibility of signing of MoUs with other National Reliability Organisations of developed countries for assimilating best practices. He stated that the North-American Electric Reliability Corporation (NERC), the reliability organization for North America, was contacted to explore the possibility of signing MoU. However, NERC had stated that they do not, as a practice, sign MoUs. However, they could provide whatever specific information was needed. Member Secretary also stated that the system operators of Ireland and Spain were approached

w.r.t signing MoU with the National Reliability Organisations of those countries, since these countries have a very high penetration of renewable sources of energy of the intermittent type, and it would be worthwhile knowing the practices adopted by these countries to ensure reliability. He stated that correspondence on the same was in process.

10. He also apprised the NRCE that the scheme of NRCE was in the process of formulation, for funding the same, which would subsequently be sent to the Ministry of Power for approval. A copy of the presentation made by Member Secretary is at Annexure-III.

11. Member Secretary stated that letters have been received by the Chairperson, CEA from M/s Jindal Power and M/s Adani Power, requesting to become members of the NRCE, since the same was also in line with the discussions of the Central Advisory Council of the CERC on 12.5.2014. Chairperson, NRCE suggested that this may be discussed when all members of the NRCE are present.

12. The following decisions were taken:-

a) Certification of TTC, ATC and TRM for June 2014 could not be done due to paucity of time and also due to lack of discussion on the methodology for determination of the same. It was decided that the sub-group along with any members of NRCE, if they so desire, would sit in NLDC and interact with them to find out the methodology of determination of TTC, ATC and TRM, sometime between 10th and 15th of June 2014.

b) The decisions to include private generators as members of the NRCE would be taken when all or most of the NRCE members are present.

13. The meeting ended with the vote of thanks to the Chair.

Annexure-I

ATTENDANCE SHEET

2nd MEETING OF NATIONAL RELIABILITY COUNCIL FOR ELECTRICITY ON 26.05.2014

S.NO	Name & Designation (Sh/Smt)	Organization	Contact No.	e-Mail ID
1.	P. K. Pahwa, Member (GO&D)	CEA	9818243524	ppahwa@cea.nic.in
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5.	Ajay Talegaonkar	SE(O)NRPC	9910728144	seonrpc@yahoo.in
6.	S.R.Narasimhan	AGM, NLDC, POSOCO	9971117022	srnarasimhan@posoco.in
7.	K.V.S. Baba	GM, NLDC, POSOCO	8527607575	kvsbaba@posoco.in
8.	Mukesh Khanna, AGM (CTU-PCG)	Powergrid	9910378098	mkhanna@powergridindia.com
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11.	A.R. Abhyankar	IIT, Delhi	9711288083	abhyankar@ee.iitd.ac.in
12.	Pankaj Batra, CE (IC), RA	CEA	9350981062	Pankaj_batra@hotmail.com
13.	D.K. Meena, Deputy Director, RA	CEA	9968031130	dharmendrak2000@rediffmail.com
14.	Pankaj Verma, AD, RAQ	CEA		

Annexure-II

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Dynamic Line Ratings
for
Optimal and Reliable Power Flow

Enhanced Power Flow for the Smart Grid

Sandy K. Aivaliotis
Senior Vice President
The Valley Group, a Nexans company

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a Nexans company

Nexans and The Smart Grid

- High Temperature Overhead Transmission Conductors
- Superconductivity
  - World's First HTS Power Transmission Cable System
    - Energized April 22, 2008 in Long Island, New York
    - Partnership with DOE, LIPA, Nexans, Air Liquide and American Superconductor
- Superconducting fault current limiter (MV)
- **Dynamic Line Ratings**

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Dynamic Line Ratings

- What are Dynamic Line Ratings?
- Reliable Dynamic Line Ratings for the Smart Grid
- Why Employ Dynamic Line Ratings?
- Tangible Benefits of Dynamic Line Ratings?

DLR and the Smart Grid

- U.S. Department of Energy
  - "Smart Grid System Report", July 2009
    - One of eight Smart Grid Metrics for T&D Infrastructure
    - Nascent Penetration / Maturity
    - "The deployment of dynamic line rating technology is also expected to increase asset utilization and operating efficiency…"
    - "For example, optimized capacity can be attainable with dynamic ratings, which allow assets to be used at greater loads by continuously sensing and rating their capacities."
- Federal Energy Regulatory Commission
  - "Smart Grid Policy"
    - Wind Integration
    - Wide Area Situational Awareness (WASA)
    - **"…knowing current state of available resources…and transmission capabilities"**

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Static vs. Dynamic Line Ratings Key Concepts

- **Weather conditions affect directly the capacity of an overhead transmission line to transmit power – its rating**
  - Wind speed and direction
  - Solar radiation
  - Ambient temperature
- **Static vs Dynamic Weather Conditions in Determining Line Ratings**
  - Static: Assumes constant weather conditions, over an extended period of time, days, months or years, neglecting weather variability
  - Dynamic or Real Time: Takes into account changing weather conditions in real time, especially the random and significant wind variability
- **Dynamic (Real Time) vs. Static Ratings**
  - Dynamic Line Ratings provide the operator with the overhead transmission line's actual ability to carry power at any moment in time while respecting design limits, such as conductor temperature and "next limiting element"

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How Weather Conditions Affect Line Ratings

Relative Impact of Ambient Conditions on Line Ratings

20 mile transmission line (795 ACSR) with a **static** thermal rating of **787 amps** at 40^{0}C ambient, zero wind, and mid-day summer

Ambient Temperature:			
2^{0}C fluctuation	→	+/-2% capacity	
10^{0}C drop in ambient	→	+ 11% capacity…	874 amps
Solar Radiation:			
Cloud shadowing	→	+/- a few percent	
Middle of night	→	+ 18% capacity…	929 amps
Wind increase 1m/sec:			
45^0 angle	→	+ 35% capacity…	1,060 amps
90^0 angle	→	+ 44% capacity	

The Un-Harnessed Power of Dynamic Line Ratings

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Variability of Wind
Two Sites Along a Transmission Line

Two Sites, 2 Km Apart

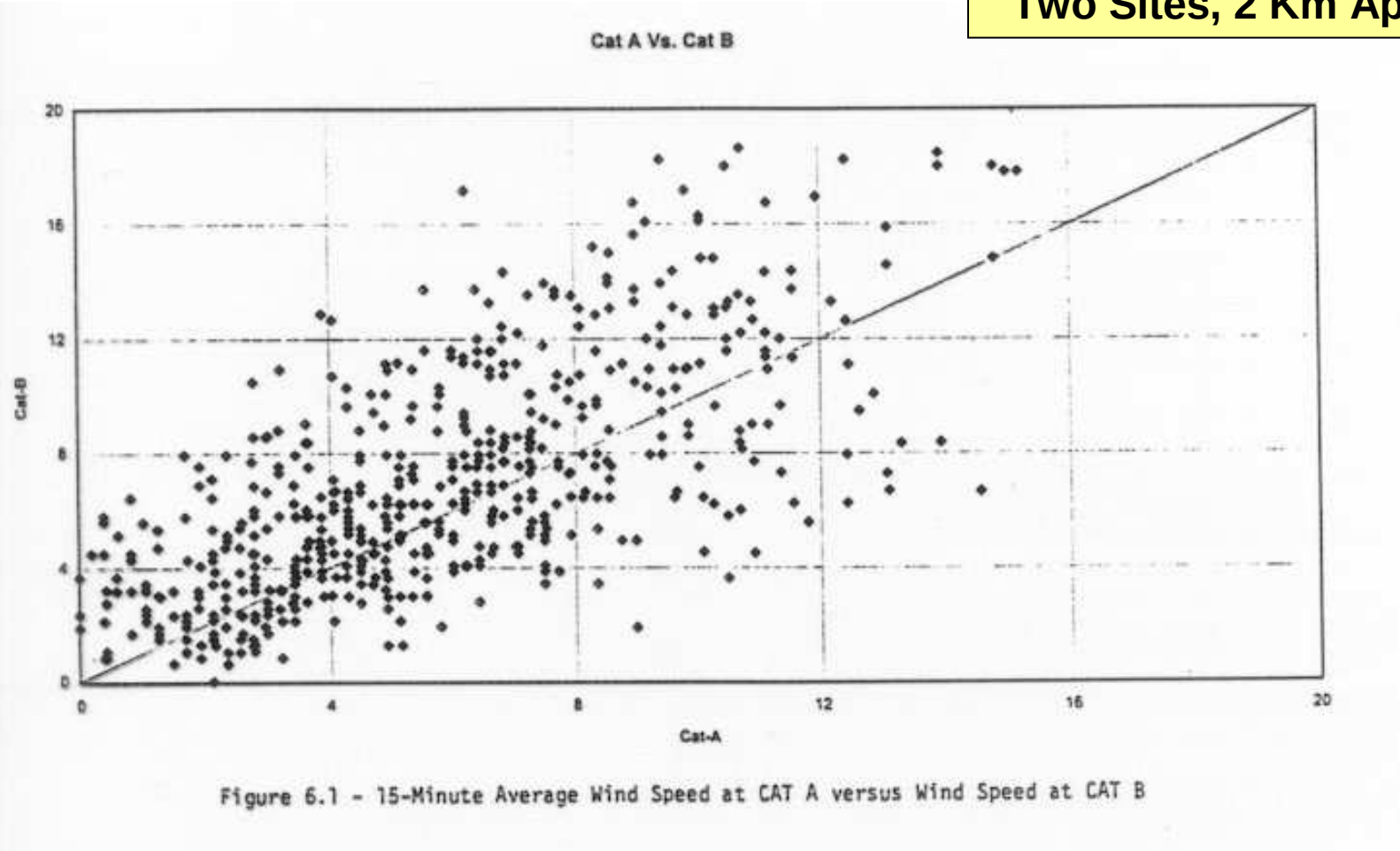

Figure 6.1 - 15-Minute Average Wind Speed at CAT A versus Wind Speed at CAT B

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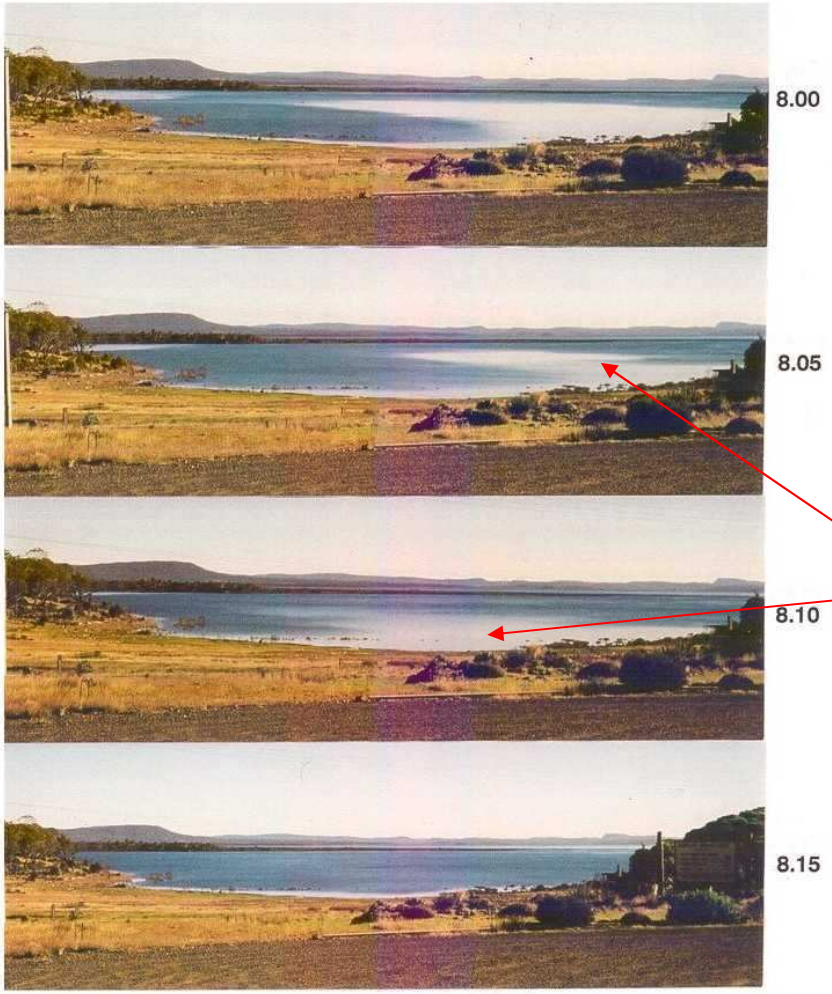
Variability of Wind Impact on Line Ratings



- Wind patterns on a bay of Great Lake, Tasmania
- Five Minute Intervals
- 8:00 a.m. to 8:15 am, 8 March 1998

A transmission line across this lake would see different conditions along its length, in that 15 minute period, affecting its transmission transfer capacity

Testing at ORNL validates this observation

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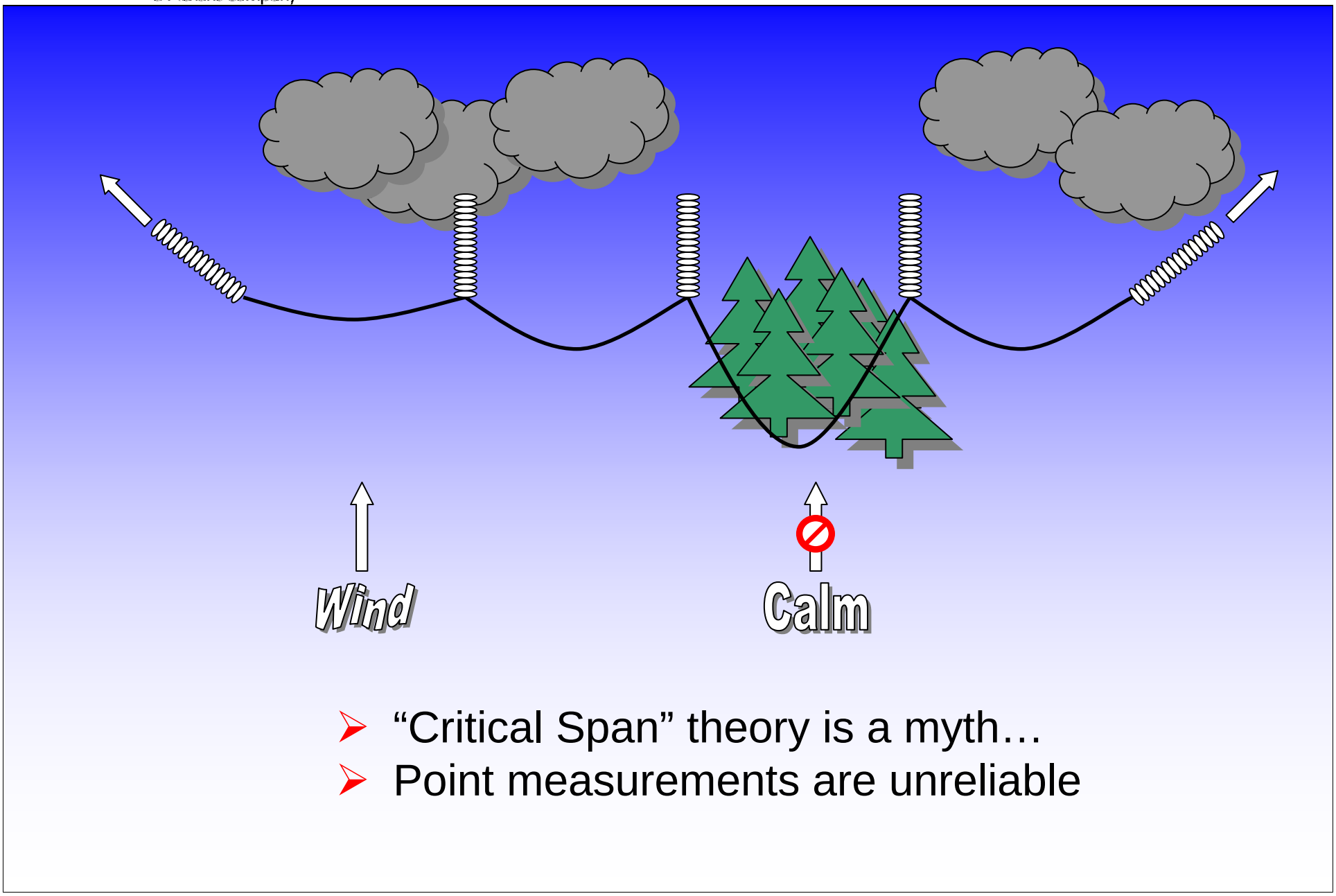
Why Tension Monitoring?



- “Critical Span” theory is a myth…
- Point measurements are unreliable

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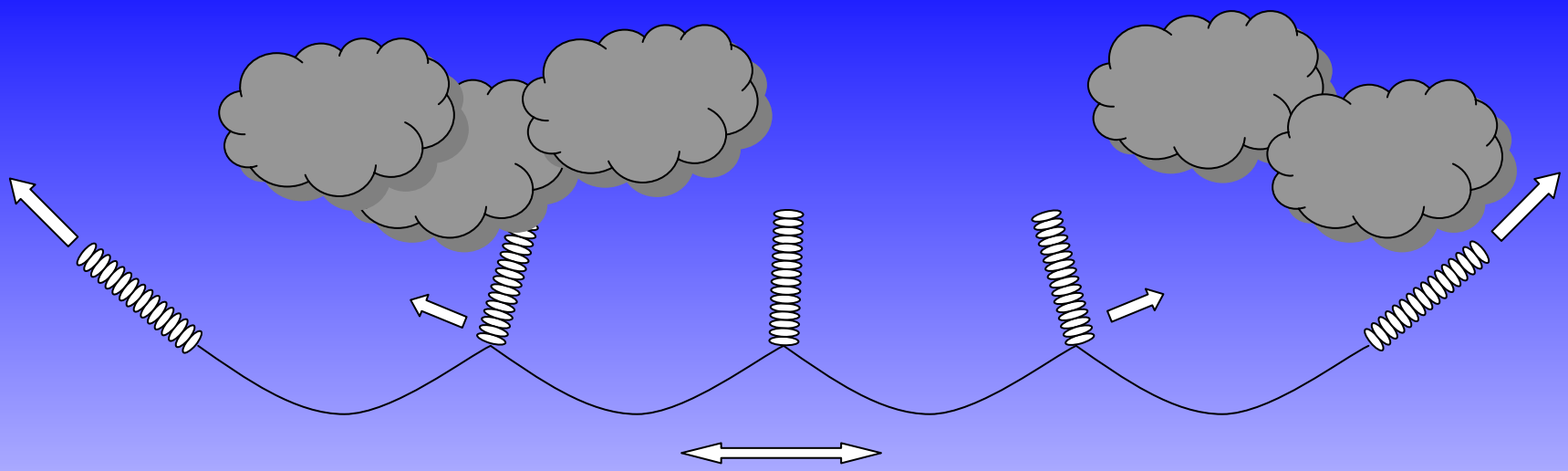
Why Tension Monitoring?



T ~ f

- Suspension insulator strings swing to equalize horizontal conductor tension
- Monitoring the conductor's tension resolves the varying wind conditions along the transmission line
- A conductor's tension is directly related to the average temperature of all the spans in the line section

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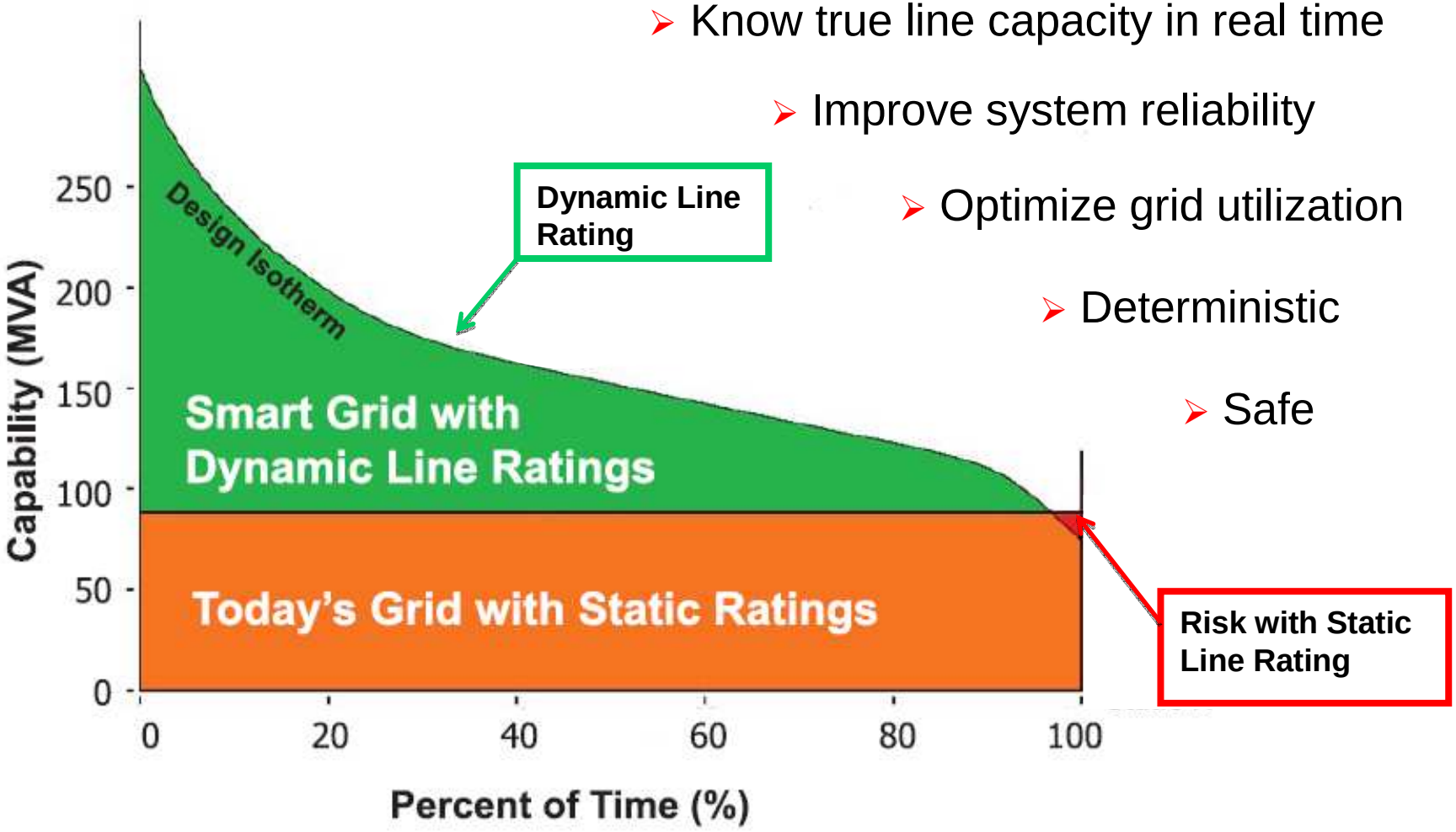
The Smart Grid and Dynamic Line Rating

- Know true line capacity in real time
- Improve system reliability
- Optimize grid utilization
- Deterministic
- Safe



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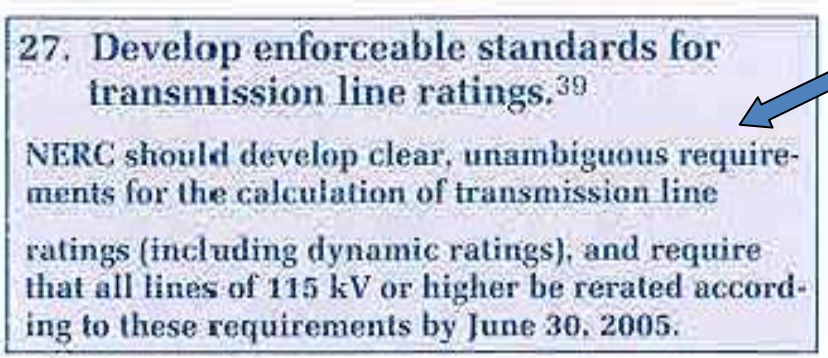
What About Grid Reliability?


27. Develop enforceable standards for transmission line ratings.[39]

NERC should develop clear, unambiguous requirements for the calculation of transmission line ratings (including dynamic ratings), and require that all lines of 115 kV or higher be rerated according to these requirements by June 30, 2005.

U.S.-Canada Power System Outage Task Force
August 14th Blackout: Causes and Recommendations

Key Findings of the Task Force

"As seen on August 14, inadequate vegetation management can lead to the loss of transmission lines that are not overloaded, at least not according to their rated limits. The investigation of the blackout, however, also found that even after allowing for regional or geographic differences, there is still significant variation in how the ratings of existing lines have been calculated. This variation—in terms of assumed ambient temperatures, wind speeds, conductor strength, and the purposes and duration of normal, seasonal, and emergency ratings—makes the ratings themselves unclear, inconsistent, and unreliable across a region or between regions. This situation creates unnecessary and unacceptable uncertainties about the safe carrying capacity of individual lines on the transmission networks. Further, the appropriate use of dynamic line ratings needs to be included in this review because adjusting a line's rating according to changes in ambient conditions may enable the line to carry a larger load while still meeting safety requirements." [page 162 of the report]

WASA

"…there is still significant variation on how the ratings of existing lines have been calculated…variations in terms of assumed… wind speeds…"

"…ratings themselves unclear, inconsistent and ***unreliable across a region or between regions***…"

"…appropriate use of dynamic line ratings …according to changes in ambient conditions…."

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Reliable Dynamic Line Rating

- Tension-based Real Time Monitoring system for overhead transmission lines
- Tension resolves all environmental factors for accurate results
- Delivers 10% to 30% additional grid capacity 90+% of the time
- Delivers clearance warnings
- Communicates with utility's Energy Management System

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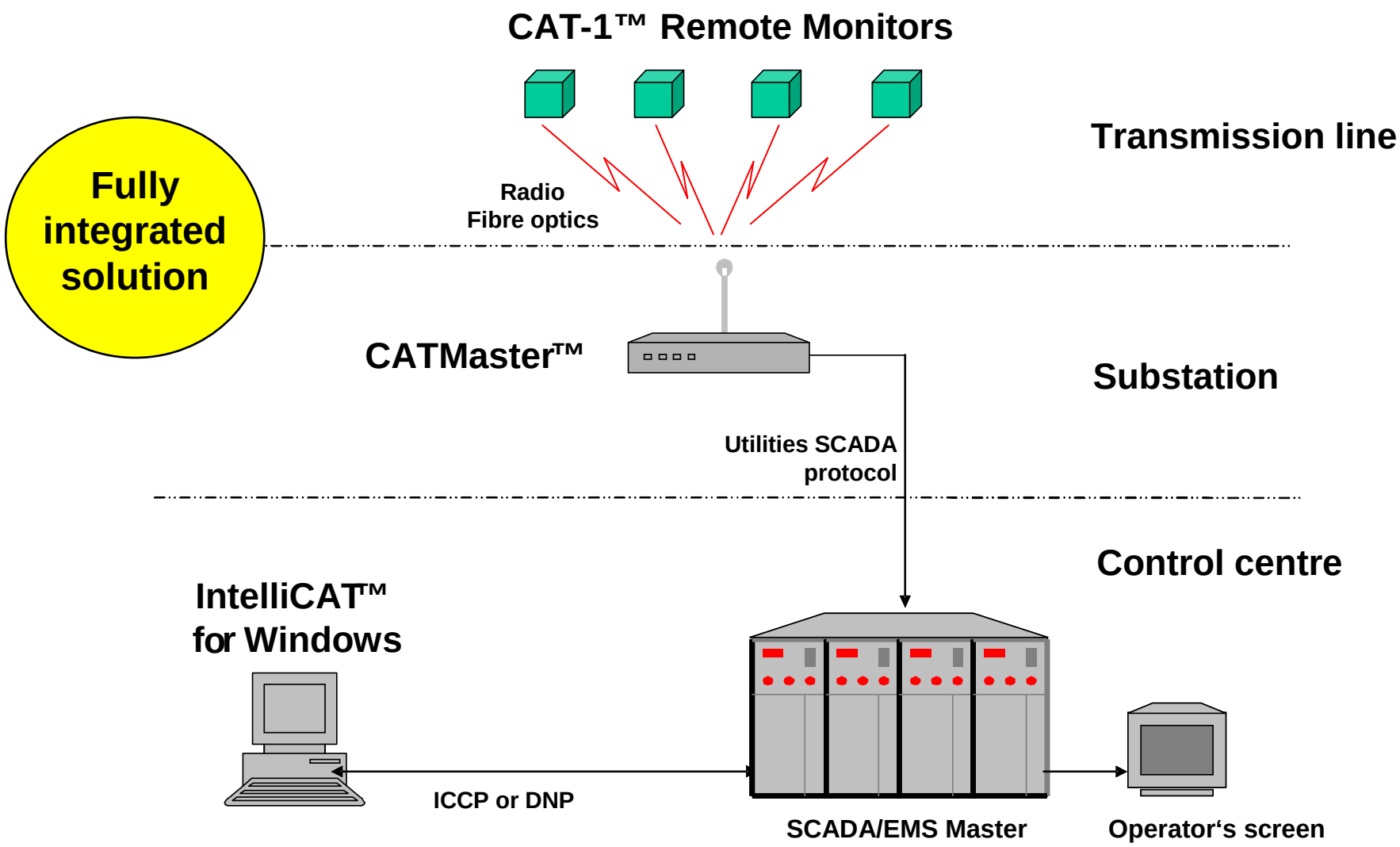
Flow Chart RTR



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Impact On Transmission Grid Operations - The Smart Grid

- A primary goal of rendering today's transmission grid "smarter' is to optimize and better manage its power transfer capacity, in real time
- A transmission grid's power transfer capacity is not constant and is primarily controlled by three elements: **stability**, **voltage limits**, and **thermal ratings**
  - All three are critical, and the Smart Grid must have a firm grip on all three elements.
  - Of the three, **thermal ratings (Dynamic Line Ratings)** represent the greatest opportunity to quickly, reliably and economically utilize the grid's true capacity
- Dynamic Line Ratings can be used along with other Smart Grid technologies (FACTS, Security Analysis) to reliably optimize and manage the power transfer capacity of the grid in real time
- The more completely and accurately the grid capacity is known, in real time, the more effective and reliable the management of the Smart Grid will be

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Transmission Line Capabilities
Thermal vs. Voltage and Stability

- Voltage and stability events are essentially instantaneous. They must be **avoided**.
- Thermal limits are time-dependent. They can be **managed**.
- Voltage and stability events are **reliability** concerns.
- Thermal events are reliability concerns, but even more importantly, **safety** concerns.

Reliable Dynamic Line Ratings Must:

- ✓ Take advantage of varying environmental conditions, reliably, in real time
- ✓ Enhance WASA along entire transmission line and interconnections
- ✓ Optimize the utilization of existing and new transmission lines, while respecting all design limits, 100% of the time
- ✓ Provide improved visualization and early warning for **safe** operation

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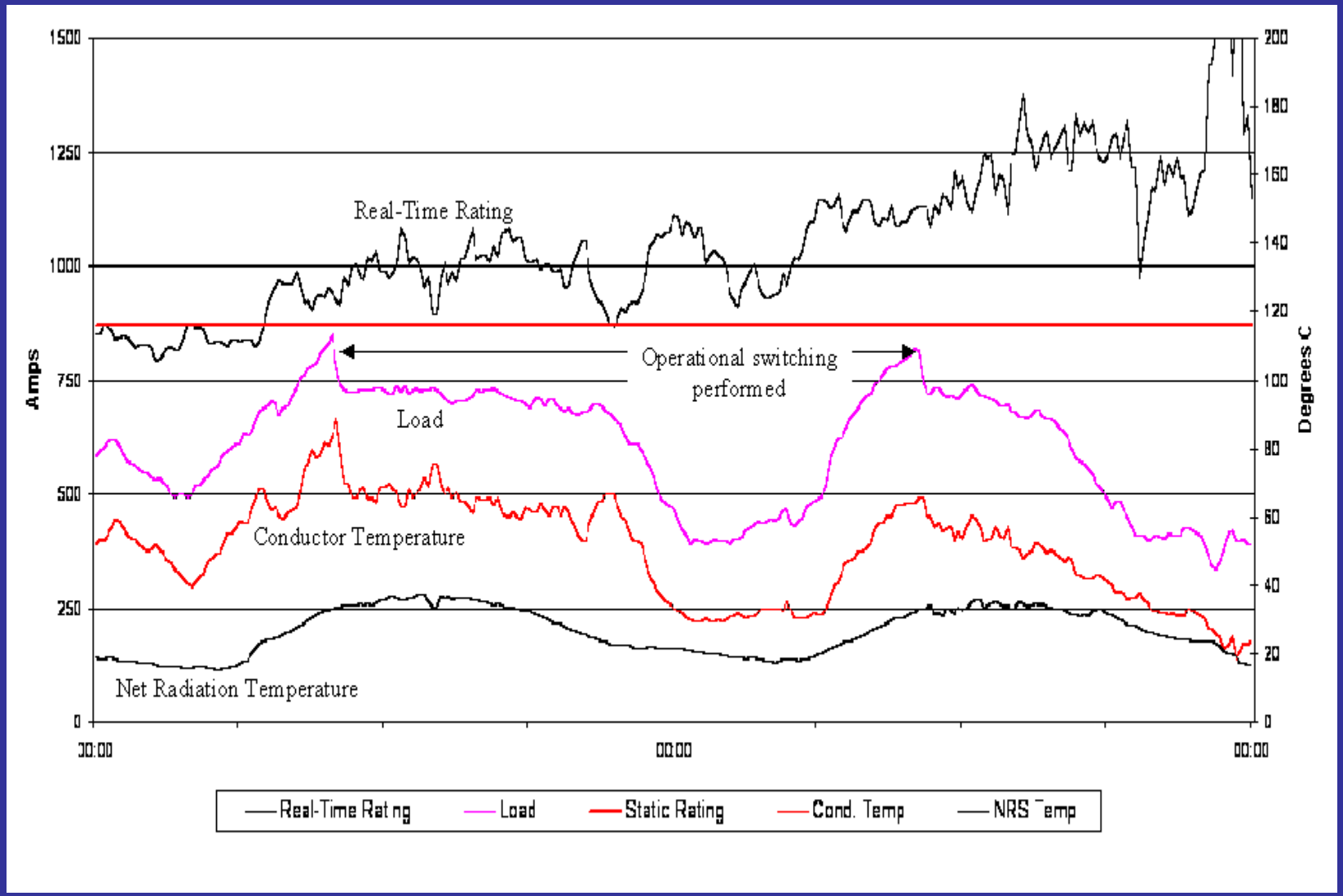
Impact on Transmission Grid Operations



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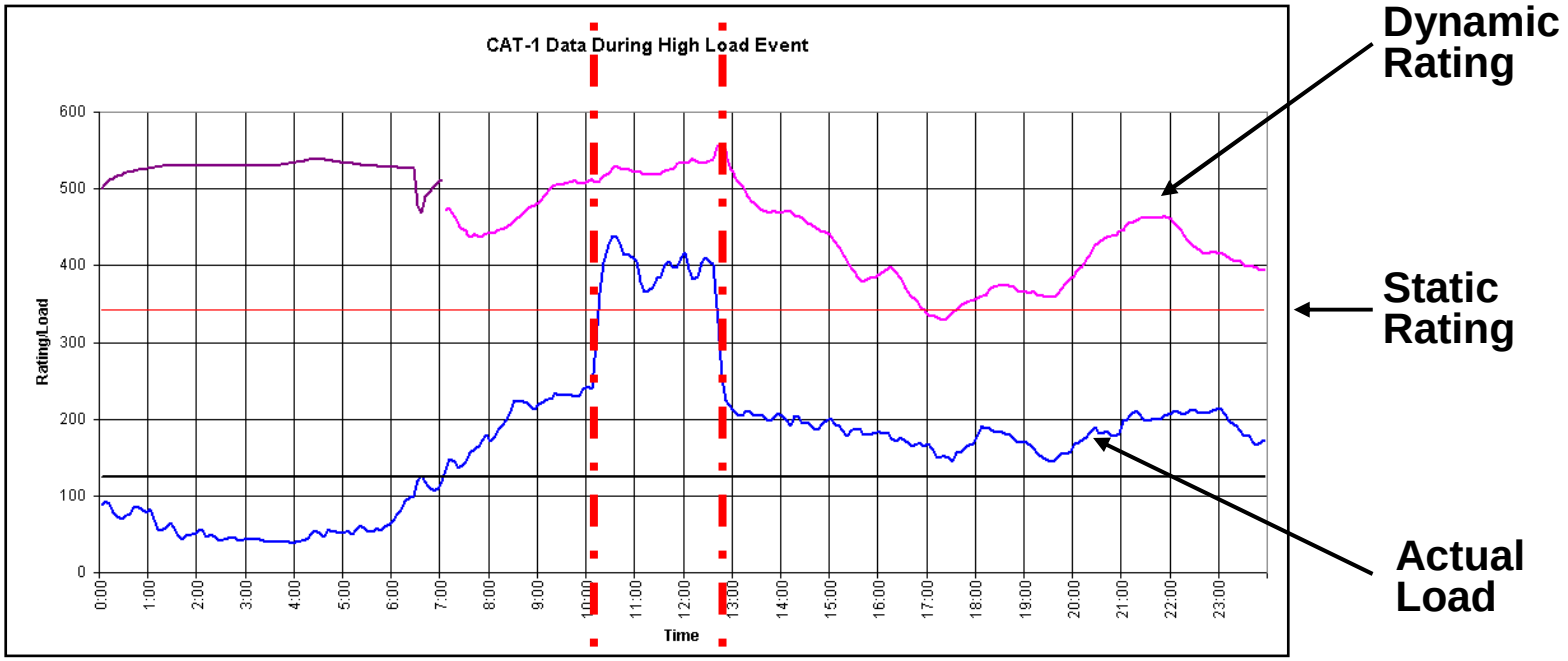
Impact On Transmission Grid Operations



- Line was operating within limits in accordance with NERC standards; without DLR, this event must be reported as a violation
- The operator would have been forced to move the grid off its optimum (most secure) dispatch

- **Example Of Safely Managed Contingency**
- **Improved Transmission Grid Reliability**

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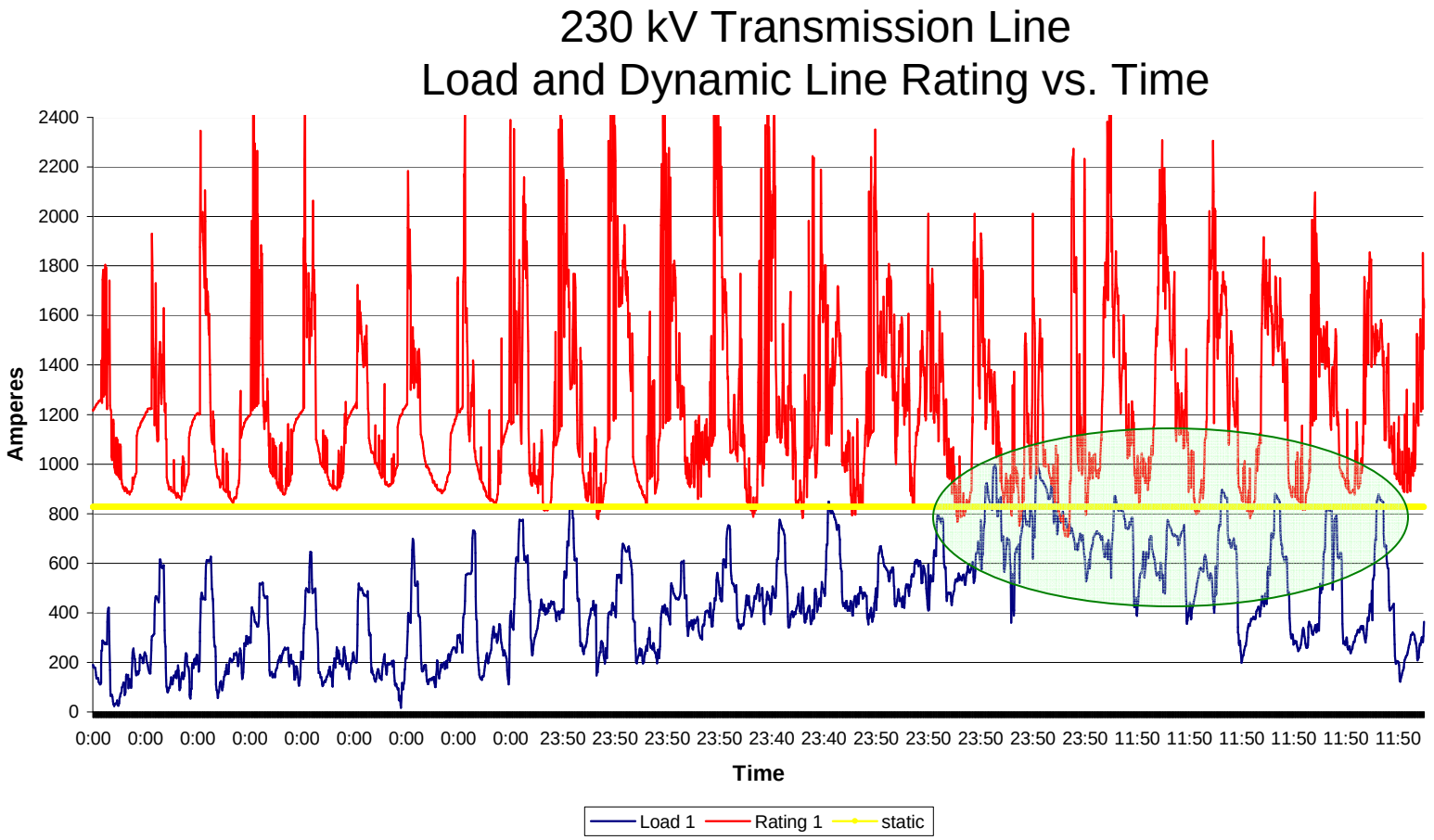
Impact On Transmission Grid Operations



- **Reduced Need For Operator Intervention**
- **Improved Reliability**

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Impact On Transmission Grid Operations

If this 230 kV line were operated according to present NERC rules:

Operator Intervention	Without Dynamic Line Ratings	With Dynamic Line Ratings
Number of Days Required in Month	**9 days** →	**2 days**
Number of Hours Required in Month	**45 – 65 hrs** →	**4 – 5 hrs**
Longest Curtailment	**10 hrs** →	**2 hrs**

In addition, curtailments would have been less severe using Dynamic Line Ratings

➢ **Optimum Dispatch Maintained - Improves Economy**

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Integration of Wind Energy

Wind generators are located in windy regions, which can benefit *substantially* from Dynamic Line Ratings

- Increased line ratings on existing **and** new transmission lines
- Common static rating assumption: 2 ft/sec wind speed. At 4 ft/sec, rating increases approximately **15%**
- Reduced need for special protection schemes
- Earlier delivery of more MW to market: typically **< 90 days**
- Reduced carbon footprint
- Dynamic Line Ratings can be operational in a few weeks, without permits, at less cost than just the permitting process!

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Ice Monitoring

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So, Why Dynamic Line Ratings?

- Cost Effective
- Congestion Relief
- Improved Grid Reliability
- Optimized Asset Utilization
- Lower Prices to Consumers
- True Line Capacity in Real Time
- Improved Transmission Efficiency
- Faster Integration of Wind Energy
- Wide Area Situational Awareness (WASA)

Green Technology

A True **Low Hanging Fruit** for the Smart Grid

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An Optimized, Reliable, and Happy Grid

Dynamic Line Ratings
Operational Use Translated To Results

Case Studies

- Three Major Utilities
- Same Technology
- Different Applications

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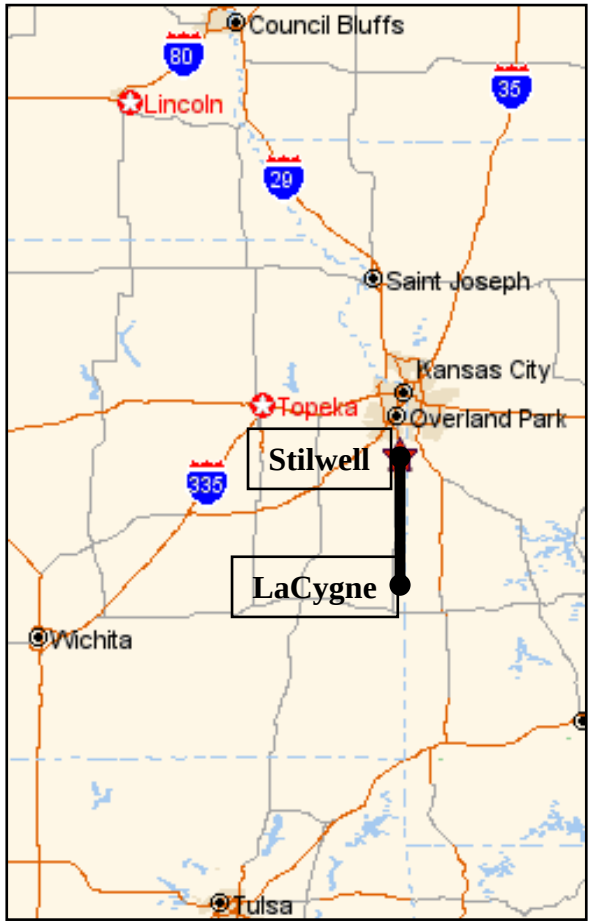
KCP&L – Congestion Relief

- LaCygne-Stilwell Flowgate in Southwest Power Pool
- 345KV, 32 miles
- 1251 MVA static rating
- 1 of top 5 bottlenecks on Central U.S. North-South power corridor
- Access to low cost power limited by the LaCygne-Stilwell flowgate
  - Summer – Lower cost power in North flows to South to meet cooling demand
  - Winter – Lower cost power in South flows to North to meet heating demand



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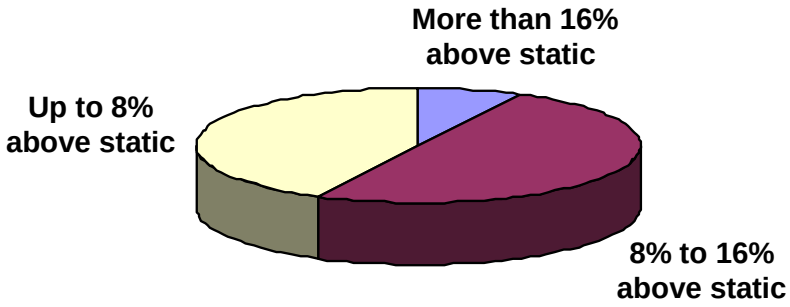
KCP&L – Congestion Relief

- Line was operated above static limit for **167 hours** late June to early September**:**



- KCPL avoided "a significant amount" of energy redispatch
- Calculated less than 3-month payback for total installed cost
  - Acquisition, installation and calibration
  - Engineering project management
  - Field verification of readings

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KCP&L – Congestion Relief

- Before installation of real time ratings
  - Firm and Non-firm power contracts were curtailed by the flowgate's constraint
- After installation of real time ratings
  - No curtailment of firm power contracts; increased capacity for non-firm contracts
  - Least cost power delivered to consumers

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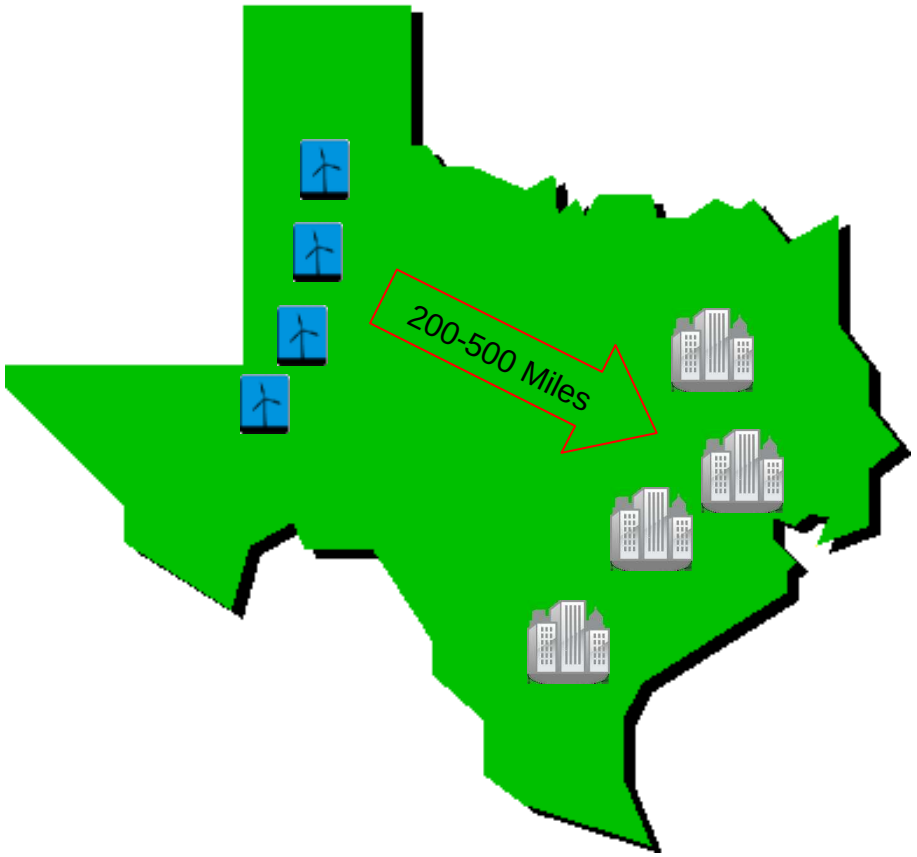
AEP West
Wind Farm Integration

- The best wind is located far from load centers
- Existing transmission capacity is modest in the vicinity of wind farms, and limits the amount of wind power that can be delivered to load centers
- Wind farms are being added faster than transmission lines can be built
- New transmission capacity is planned, but will take years to build



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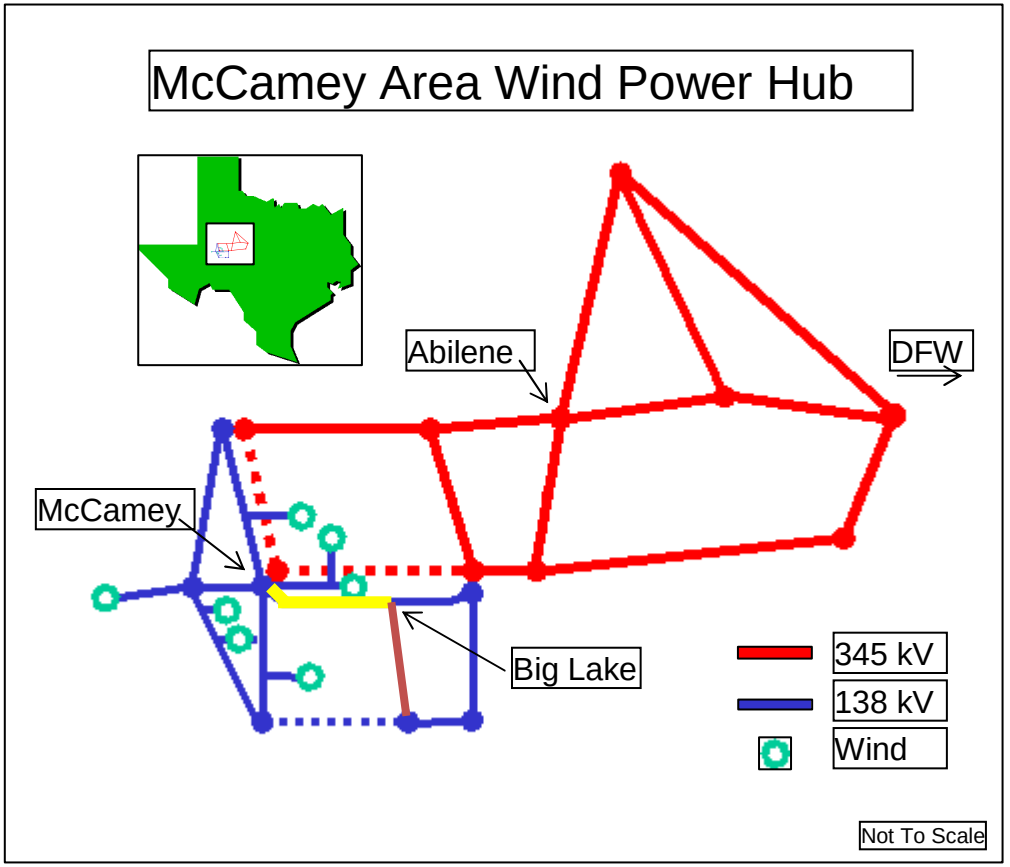
AEP West
Wind Farm Integration

- The power output of several wind farms is concentrated at the McCamey transmission hub
- The amount of wind power that can be delivered to load centers in East Texas is limited by the rating of the 138 kV transmission line from McCamey to Big Lake



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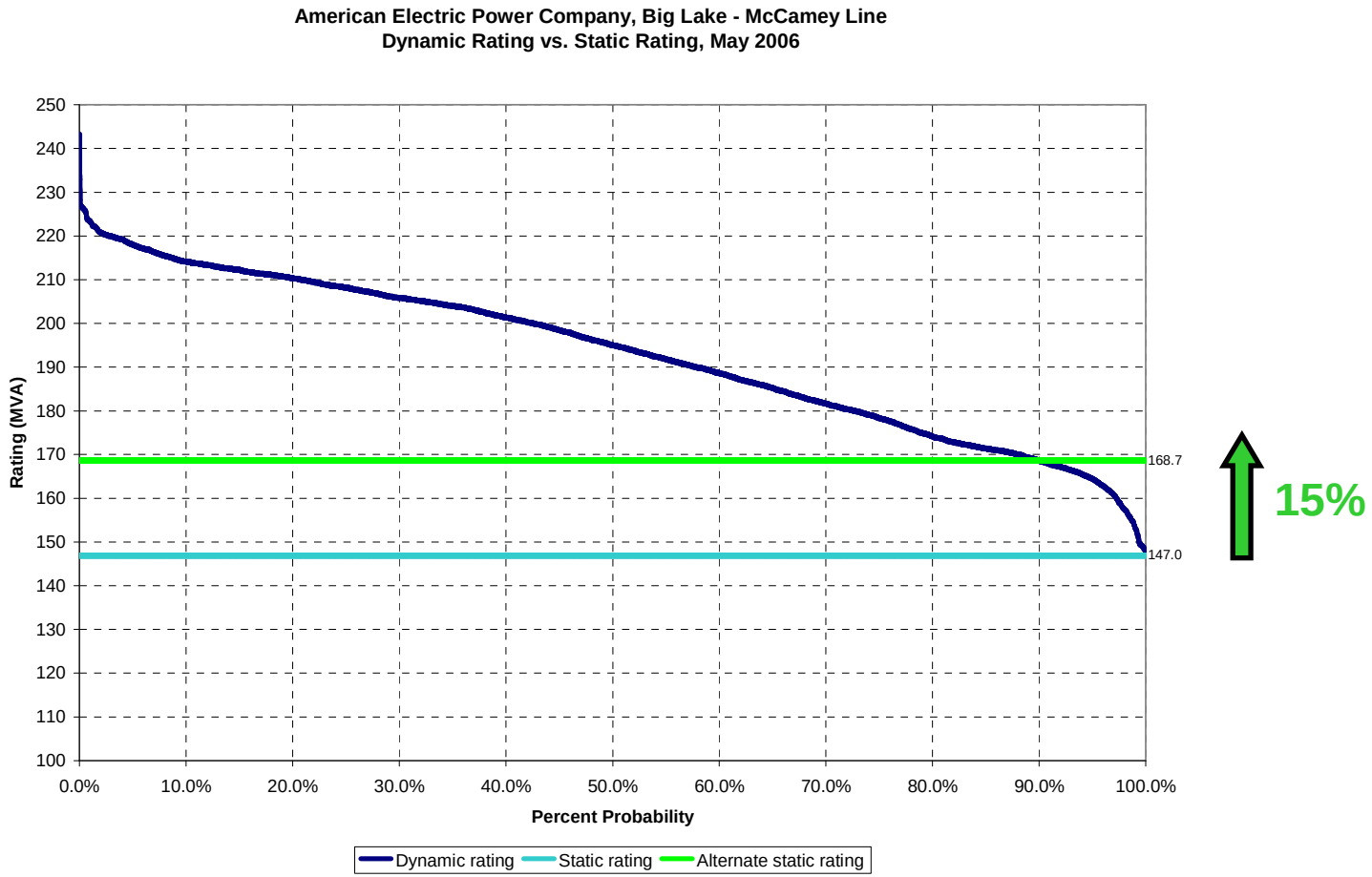
AEP West
Wind Farm Integration



Real time ratings on the McCamey-Big Lake line deliver a minimum of 10-15% above static rating when needed to accommodate wind power

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AEP West
Wind Farm Integration

- Real time ratings enabled an immediate 10-15% (minimum) increase in the delivery of wind power over existing transmission assets
  - More renewable energy to market, faster, and at lower cost
  - Maximized use of existing transmission assets
- Real time ratings deferred a physical line upgrade estimated at $20M
  - The line upgrade would be of no use when planned new transmission lines were completed. A stranded asset was avoided.

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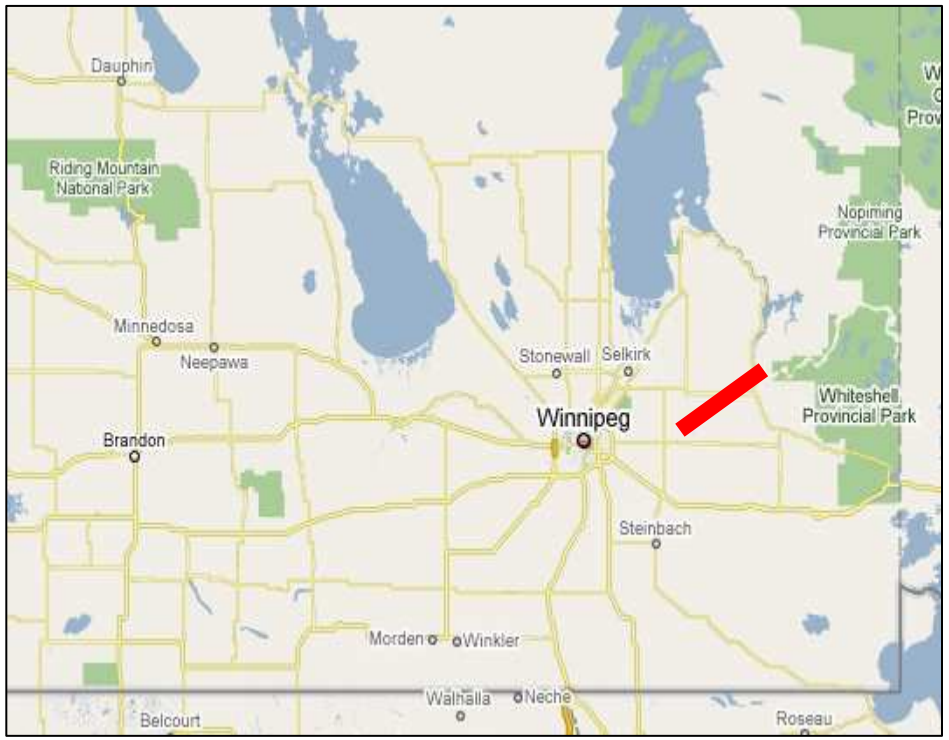
Manitoba Hydro
Avoiding Curtailment

- Seven Sisters – Vivian Tap (ST6)
- 115 kV, 45 km
- 232 A static rating
- Intermittent loading constraints result in curtailing low cost hydro generation needed to optimize economic dispatch
- Maintenance and capacity upgrades are planned, but not scheduled for years



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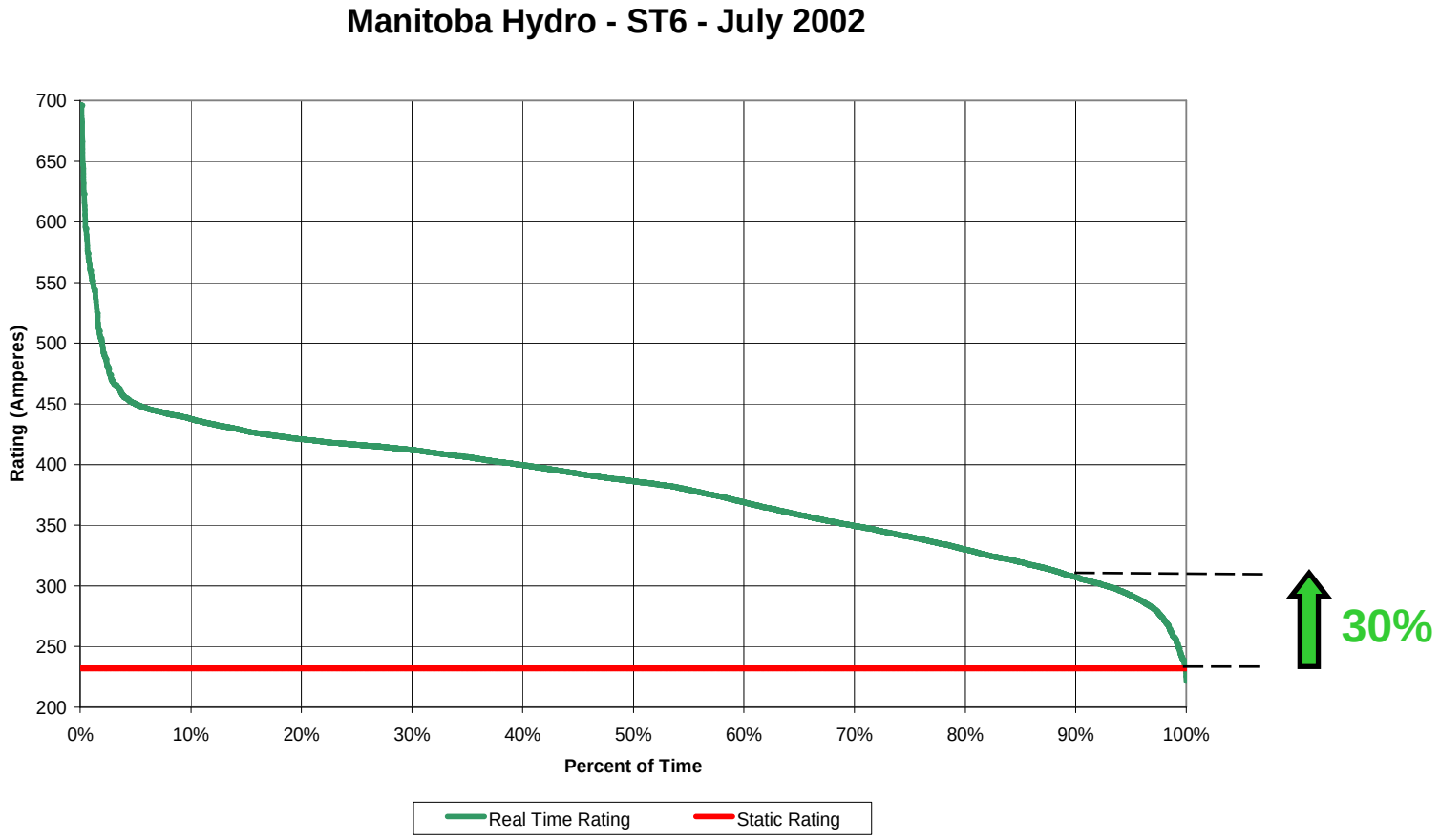
Manitoba Hydro
Avoiding Curtailment



Real time ratings on ST6 are above the static rating 99.9% of the time and 30% above the static rating 90% of the time

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Manitoba Hydro
Avoiding Curtailment

- Real time ratings provide access to existing transmission capacity above the static rating
  - Curtailment of hydro generation avoided
  - Lowest cost power delivered to consumers
  - Unnecessary, and potentially reliability threatening, redispatch avoided
- Maximum utilization of the existing transmission asset.
  - Greater ROI
  - Planned upgrades stay on schedule. No artificial and costly acceleration to accommodate unexpected constraints

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Summary - An Enabling Technology for the Smart Grid

- The technology to accurately measure the dynamic rating of a transmission line has been well established
- Dynamic Line Ratings provide awareness of and access to the true capacity for the Smart Grid in real time
- Dynamic Line Ratings are available at the operator's console and they are a practical tool with which operators can effectively manage the grid
- Dynamic Line Ratings increase grid reliability by providing enhanced wide area situational awareness and by enabling operators to reduce the number of times they must intervene to make system adjustments
- Knowing true transfer capacity is essential to efficiently manage the grid's reliability and economic use
  - whether it be through direct use of Dynamic Line Ratings by system operators or
  - as accurate inputs to integrated Smart Grid technologies
- Quick installation with fast payback

Additional Information

For additional information, please contact:

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Annexure-III

SECOND MEETING OF THE NATIONAL RELIABILITY COUNCIL

26.5.2014

AGENDA

- Approval of Total Transfer Capability (TTC), Available Transfer Capability (ATC) and Transmission Reliability Margin (TRM) by the sub-group of NRCE to carry out examination of the System Studies for the purpose of calculation of TTC, ATC and TRM for the month of June 2014.
- Discussion of guidelines for determination of TTC, ATC and TRM in real time.
- Update on interaction with NERC and other National Reliability Organizations.
- Any other matter.

APPROVAL OF TTC, ATC AND TRM BY THE SUB-GROUP OF NRCE

- The calculation for determination of TTC, ATC and TRM of the last corridor/flow gate could be carried out and mailed by POSOCO only by 22.05.2014 .
- The time being too short, the System Studies and data could not be examined in detail. Therefore the TTC, ATC and TRM could not be certified by the Sub-Group for June, 2014.
- Moreover, the methodology of calculation of TTC, ATC and TRM by POSOCO had to be examined before certifying the same.
- The Sub-Group would have to meet again a few times to give their recommendations to NRCE on methodology and modalities of calculation of TTC, ATC and TRM.

APPROVAL OF TTC, ATC AND TRM BY THE SUB-GROUP OF NRCE

Points discussed on the methodology of calculation of TTC, ATC and TRM by POSOCO :

- The methodology of getting the base case for the study, and whether the peak and the off-peak scenarios were considered.
- Whether any other scenarios, other than peak and off-peak, need to be considered.
- The methodology of calculating TTC,ATC and TRM.
- What were the constraints considered?
- Loop flows in determination of TTC, ATC and TRM.
- TTC, ATC and TRM between WR and NR, ER and SR.
- System Protection Scheme (SPS) setting on 765 KV Agra-

DISCUSSION OF GUIDELINES FOR DETERMINATION OF TTC, ATC AND TRM IN REAL TIME.

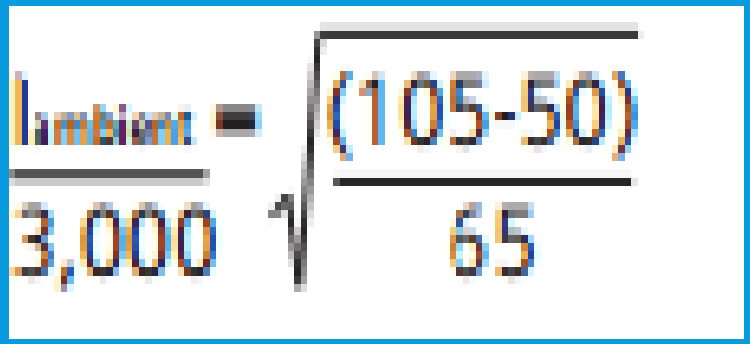
- **Permissible normal and emergency limits**
- Normal thermal ratings and normal voltage limits represent equipment limits that can be sustained on continuous basis.
- ***Emergency thermal ratings*** and emergency voltage limits represent equipment limits that can be tolerated for a relatively ***short time which may be one hour to two hour depending on design of the equipment***.
- The thermal loading limit of a line is determined by design parameters based on ***ambient temperature***, maximum permissible conductor temperature***, wind speed, solar radiation***, absorption coefficient, emissivity coefficient etc.

DISCUSSION OF GUIDELINES FOR DETERMINATION OF TTC, ATC AND TRM IN REAL TIME.

- Consider the continuous current carrying capability of a main bus in metal-clad switchgear, for which the applicable standard is ANSI/IEEE C37.20.2.
- The limit of temperature rise for silver-plated copper bus joints is 65 °C, and considering the maximum rated ambient of 40 °C, this means that the limiting total temperature for the insulation that supports or covers these buses is 105 °C.
- The fundamental relationship is that temperature rise is related *to the square of the current.*
- Suppose current carrying capacity is 3000 A, for an ambient temp of 40 °C.

DISCUSSION OF GUIDELINES FOR DETERMINATION OF TTC, ATC AND TRM IN REAL TIME.

- Therefore, for an ambient temp of 50 °C, the temperature rise permitted is 55 °C. The current carrying capability then works out to :



- = 2759 A.
- For ambient temperature of 20 °C, the current carrying capability then works out to 3430 A.

DISCUSSION OF GUIDELINES FOR DETERMINATION OF TTC, ATC AND TRM IN REAL TIME.

- Concept of Dynamic Line Rating.

UPDATE ON INTERACTION WITH NERC

- Contact established with **Mark G. Lauby**, **Vice President and Director, Standards**, North American Electric Reliability Corporation

- "Generally, NERC does not develop MOU, as most of our information is public as a non-profit organization that develops Standards in the public-interest."
- "Might I suggest, as a starting point, that you direct any questions specific to information sharing to me? We can organize a suitable response (either written, conference call or other media) to discuss the status of both organizations in this way."

UPDATE ON INTERACTION WITH IRISH GRID OPERATOR

- Established contact with Mark.Norton@Eirgrid.com, Technology and Innovation Manager.
- Managed the updating of the transmission planning criteria, working on three of the European Network codes for the connection requirements of grid users, Vision and Action plan for ENTSO-E, assessing, develop and researching new technologies.
- Teleconference proposed.

CONTACT WITH SPANISH SYSTEM OPERATOR

- **Miguel de la Torre Rodríguez**

Dpto. Centro de Control Eléctrico

Paseo del Conde de los Gaitanes 177

28109 Alcobendas, Madrid. Spain.

- **To get back on signing of MOU.**

PARTICIPATION OF PRIVATE PARTIES

- Letters from M/S Jindal and Adani for becoming members.
- CAC of CERC Minutes of Meeting dated 12.5.2014 mention this.

STATUS OFSFC MEMO FOR NRCE SCHEME

- Under process.

- Thank You.