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August 7, 2012

## MEMORANDUM

**TO:** Power Committee Members

**FROM:** John Fazio, Senior Systems Analyst

**SUBJECT:** Report on Discussion of Reliability Standards used in other Regions

Section 1201 of Title XII in the 2005 Energy Policy Act (EPAct), subtitled "Reliability Standards," creates an Electric Reliability Organization (ERO), the purpose of which is to establish and enforce reliability standards for the bulk-power system. The North American Electricity Reliability Corporation (NERC) is the ERO certified pursuant to the EPAct. In its role as the ERO, NERC reviews and assesses the overall reliability (adequacy) of the interconnected bulk electric systems to ensure that each sub-region complies with the planning standards. Each of the eight sub-regions is responsible for assessing its own system reliability. The Western Electricity Coordinating Council (WECC) is the sub-regional entity responsible for coordinating and promoting system reliability in the Western Interconnection.

NERC's Reliability Subcommittee established the Loss-of-Load Expectation (LOLE) work group to develop its planning standards. Unfortunately, NERC funding wasn't sufficient to sustain the work group and so, in 2012, the work group was subsumed by the IEEE Risk, Reliability and Probability Applications (RRPA) subcommittee. The task remains the same – to develop a standardized method to assess resource supply adequacy. The committee has made a tremendous amount of progress in providing a forum for the sharing of information regarding regional methodologies to assess adequacy. Very little progress, however, has been made in agreeing to a common metric, let alone an acceptable threshold for such a metric. Summaries, to date, show that seven of the eight NERC sub-regions are using probabilistic methods to assess adequacy (the lone exception is WECC, which is planning to move to similar methods in the near future). Unfortunately, candidate adequacy metrics are not always defined in the same way across NERC sub-regions and thresholds for those metrics vary substantially.

The NW Power and Conservation Council and the Northwest Resource Adequacy Forum use a probabilistic methodology to assess the loss-of-load probability (LOLP) for the regional power supply. For the power supply to be deemed adequate, its LOLP must be 5% or less. Many Northwest utilities have adopted the Council's methods and are using similar probabilistic metrics and thresholds.

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On July 26<sup>th</sup> and 27<sup>th</sup> I will be attending the annual IEEE RRPA subcommittee meeting on resource adequacy. This meeting will provide an opportunity to exchange information with representatives of other sub-regions on the approaches being used to address reliability standards. Because this meeting is being held after the packet deadline, a summary will be provided to committee members on August 7<sup>th</sup> at the power committee meeting.

# Report on Discussion of Reliability Standards used in other Regions

## Energy Policy Act of 2005



Power Committee Meeting  
August 7, 2012  
Spokane, Washington

# Topics

- **What is resource adequacy?**
- **National adequacy assessment efforts**  
**Loss-of-load Expectation Work Group meeting July 26-27**
- **PNW regional adequacy assessment efforts**

# What is an Adequacy Standard?

- **Adequacy** = having sufficient supply
- **Metric** = a quantitative measure (of adequacy)
- **Threshold** = a minimum level for an adequacy metric
- **Standard** = setting a threshold for an adequacy metric

# Example of an Adequacy Standard

- **Metric** – Annual Load/Resource Balance  
Total owned resource capability minus load
- **Threshold** – Annual L/R balance  $\Rightarrow$  zero
- Because of uncertainties in resources (hydro) and load, and because of variable resources, this type of metric is not as useful today
- Most utilities are moving to probabilistic metrics

# Probabilistic Adequacy Metrics

- **Assessed using Monte Carlo models**
- **Simulate the operation of the power system (to meet load) in many futures with different realized uncertainties**
- **Uncertainties for the NW**
  - Water supply
  - Temperature (load)
  - Wind
  - Forced outages on generating units

# Commonly Used Probabilistic Adequacy Metrics

Metric	Description
LOLP (%)	<b>Loss of load probability</b> Likelihood of a curtailment in a future year
EUE (MW-hours)	<b>Expected unserved energy</b> Average amount of curtailment per year
LOLH (hours/year)	<b>Loss of load hours</b> Expected number of curtailment hours per year
LOLE (events/year)	<b>Loss of load expectation</b> Expected number of curtailment events per year



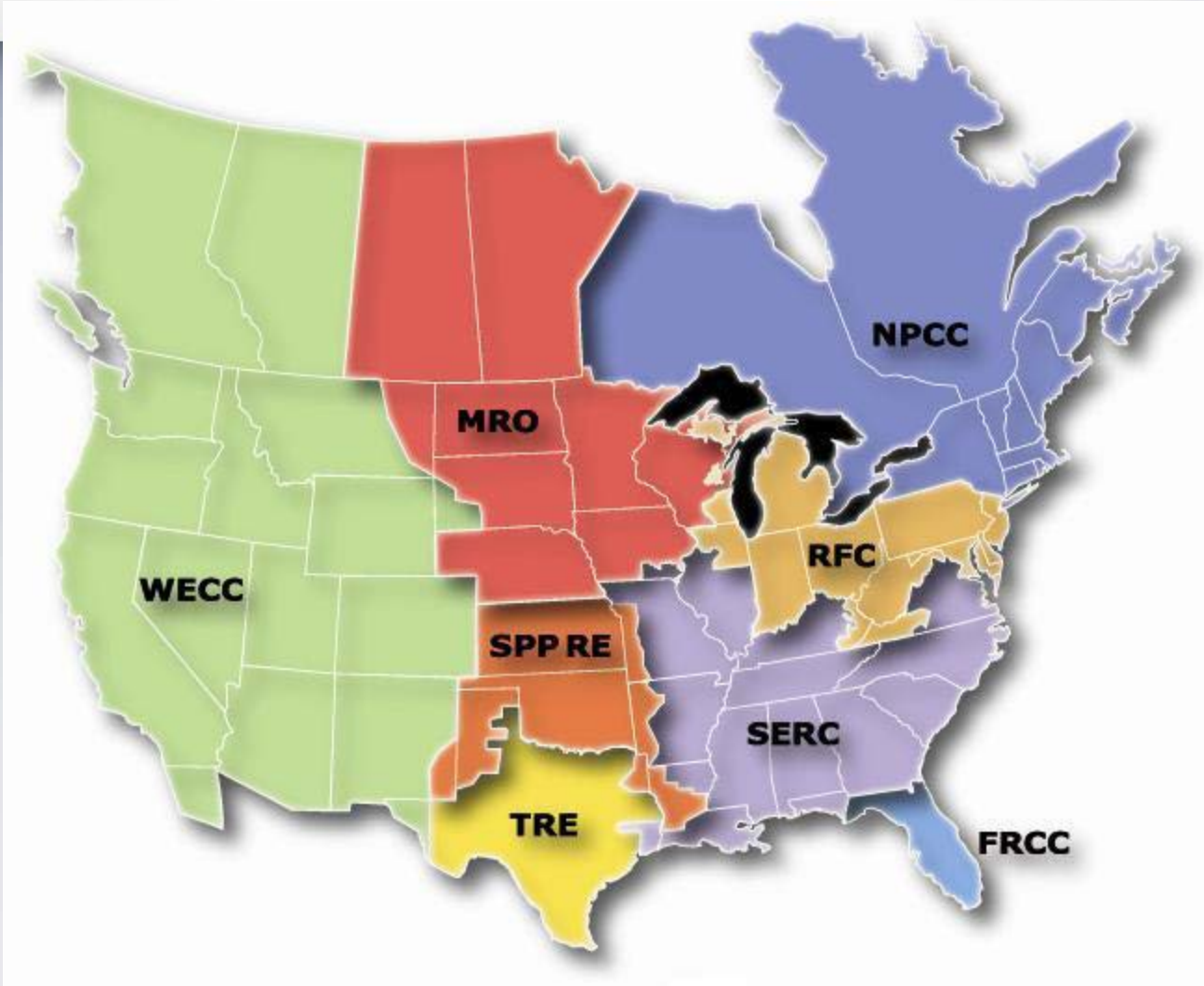
# Using Adequacy Metrics for Resource Planning

- Establish an adequacy metric and threshold
- Create a power supply that just meets the adequacy threshold
- Extract a planning criterion from that supply, such as a capacity reserve margin
- Assess the system's reserve margin (RM) with no market resources
- Add sufficient resources to meet the RM

# Impetus for an Adequacy Standard

- **2005 Energy Policy Act:**
  - Objective: to standardize adequacy assessments in the US
  - Created Electric Reliability Organization (ERO)
- **North American Electric Reliability Corporation (NERC) is the ERO:**
- **Institute of Electrical and Electronic Engineers:**
  - Risk, Reliability and Probability Applications subcommittee
  - **Loss-of-Load Expectation Best Practices Working Group**

# NERC Sub-Regions



# 2011 Pilot Probabilistic Assessment

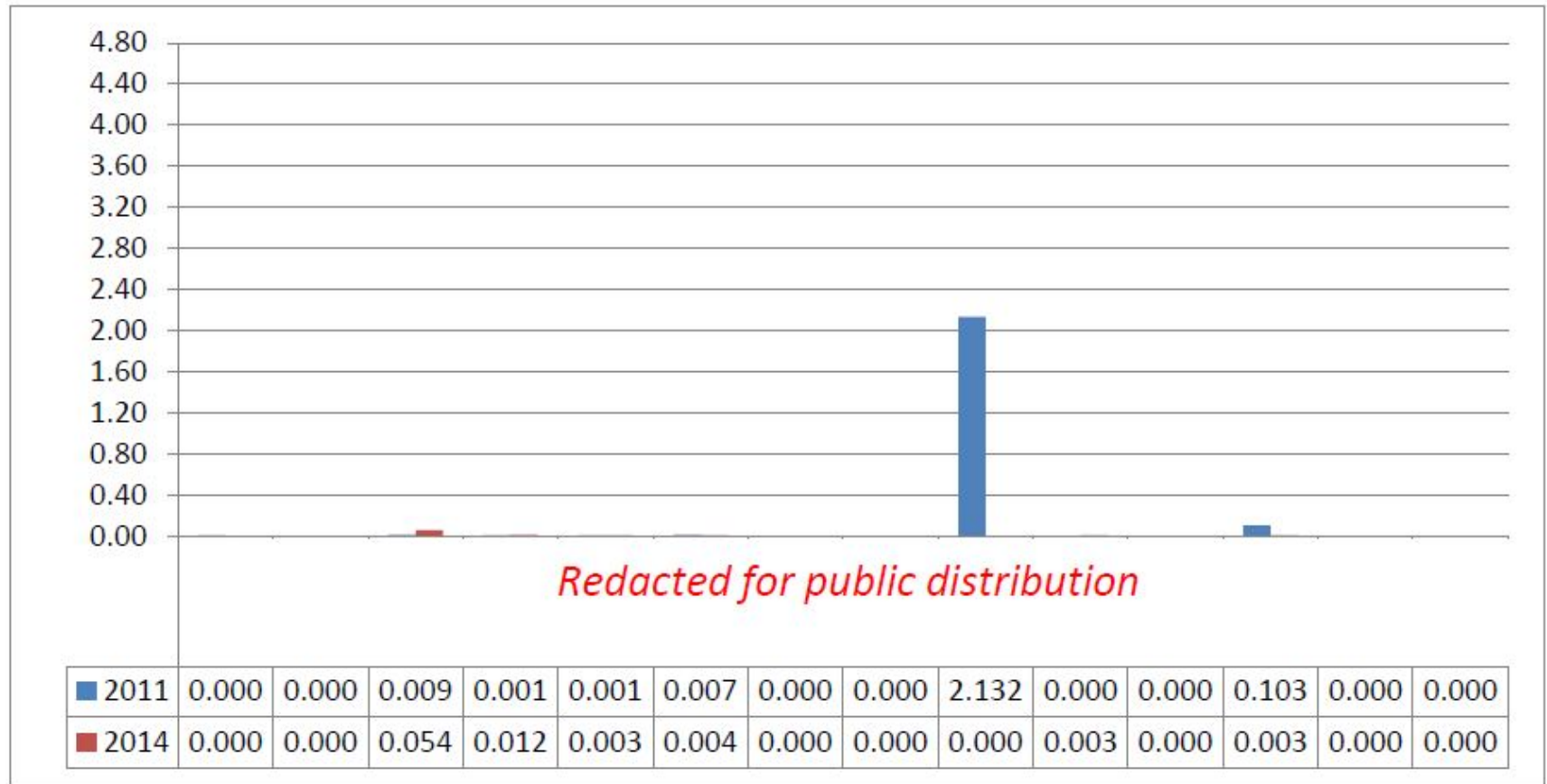
- **Who:** NERC Reliability Assessment subcommittee
- **Participating sub-regions:** All but WECC\*
- **Objective:** To establish a common set of probabilistic adequacy metrics
- **Proposed metrics:**
  - **Expected Unserved Energy (EUE)**
  - **Loss of Load Hours (LOLH)**
  - **Normalized EUE**  
(normalized relative to load)

\*Although WECC is not participating yet, the Northwest (Council) has been doing probabilistic analyses since 2000

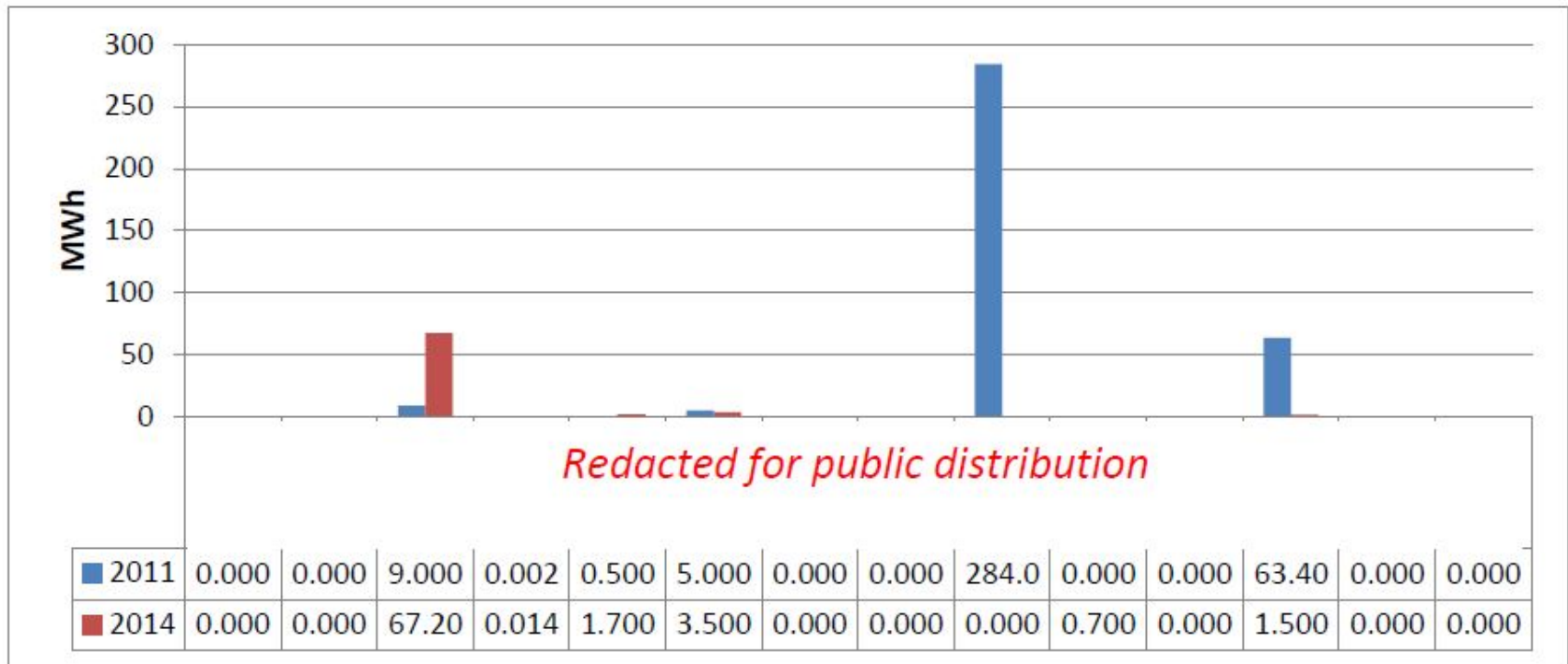
# NERC Sub-Region Models

NERC Sub-region	Model	Type
FRCC	TIGER	Recursive Convolution
Manitoba	GE MARS	Monte Carlo
MISO	GE MARS	Monte Carlo
NPCC	GE MARS	Monte Carlo
PJM	GE MARS	Monte Carlo
SERC	MARS	Monte Carlo
SPP	GRIDVIEW	Monte Carlo
WECC	PROMOD	Deterministic

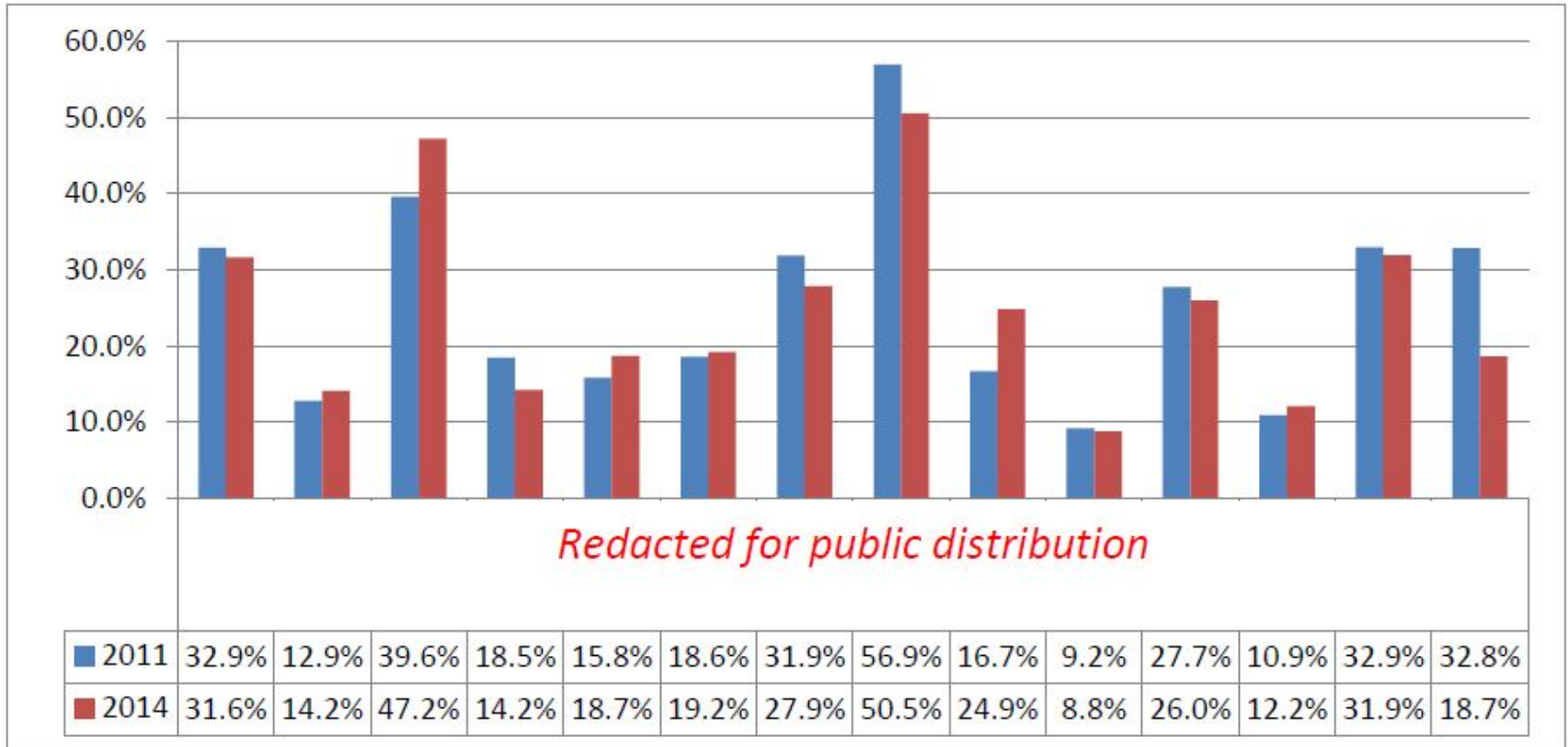
# NERC Sub-Region Loss-of-Load Hours



# NERC Sub-Region Expected Unserved Load (EUE)



# NERC Sub-Region Reserve Margin





# The Pacific NW Region

- To date WECC has used less sophisticated deterministic methods to assess adequacy
- The Council recognized the importance of probabilistic planning and created the Adequacy Forum in 2005 to develop an adequacy standard
- WECC is now moving toward a similar approach

# **DRAFT** Adequacy Assessment for 2015 (Not for Distribution)

Metric	Value	Units	Threshold
<b>LOLP</b>	<b>0.93%</b>	<b>Percent</b>	<b>5%</b>
EUE	<b>348</b>	MW-hours	N/A
LOLH	<b>0.3</b>	Hours/year	0.8 to 2.4
Reserve Margin	<b>24</b>	Percent	N/A

# PNW Utilities

- **Most using similar methods to the Council**
- **Puget Sound Energy:**
  - Uses 5% LOLP
  - Extracts a single-hour planning RM
- **AVISTA:**
  - Uses both LOLP (roughly 5%) and LOLH
  - Extracts a capacity planning RM
- **BPA:**
  - Uses GENESYS for federal adequacy assessment
  - Supports their needs assessment analysis