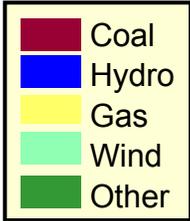
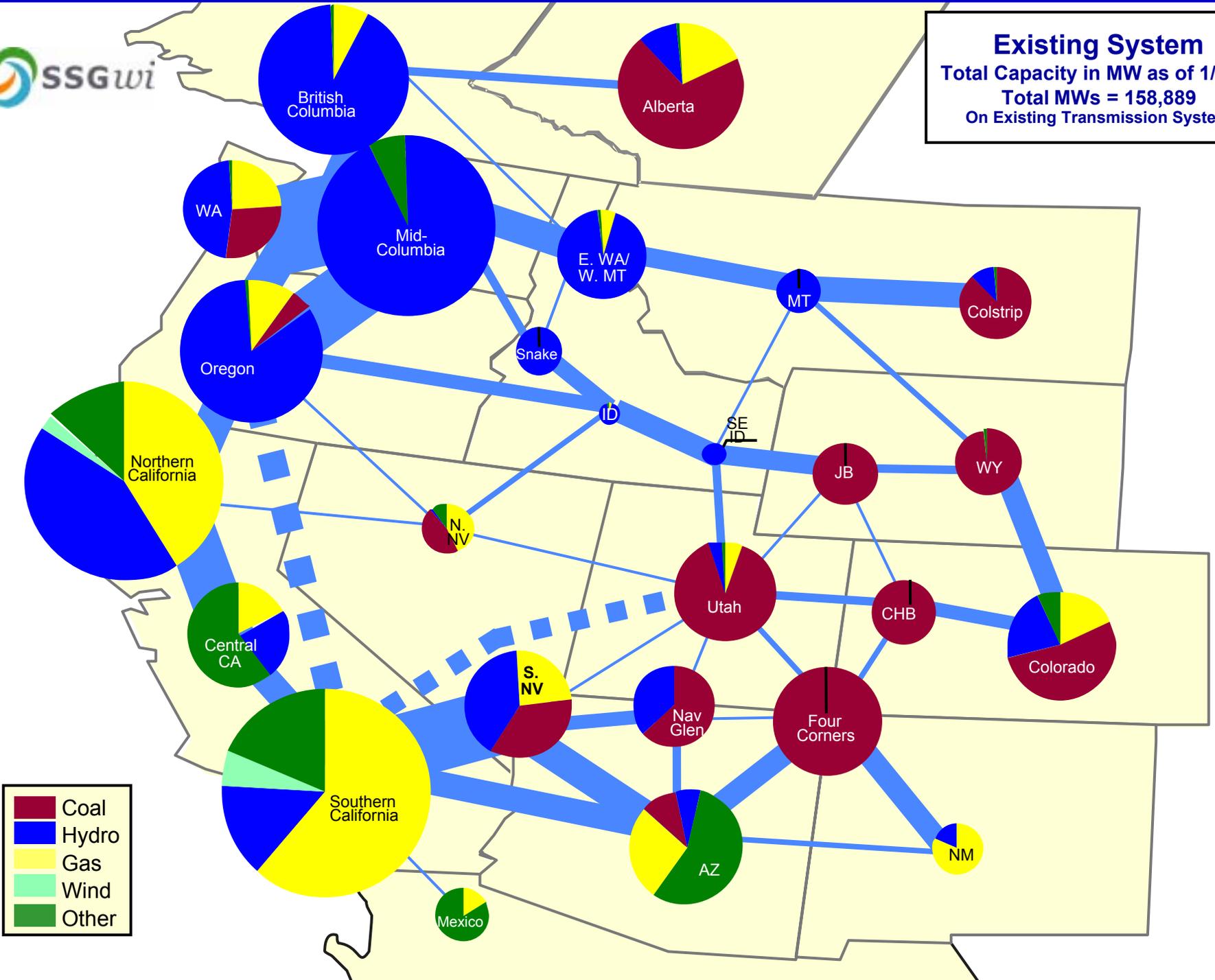


**DOE**  
**Workshop on Designation of National Interest**  
**Electric Transmission Bottlenecks**



**Transmission Planning in the West**  
Steve Waddington  
July 14, 2004

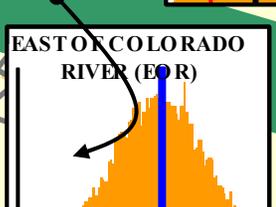
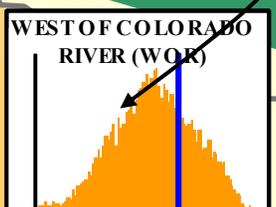
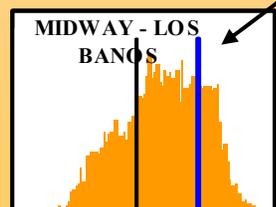
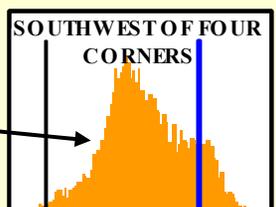
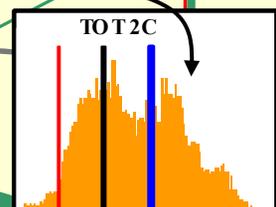
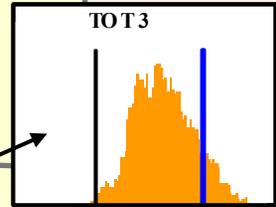
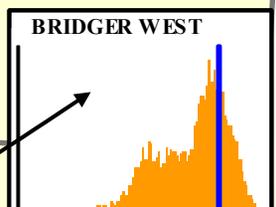
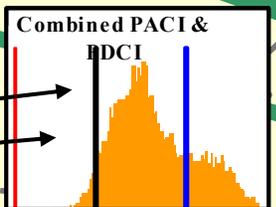
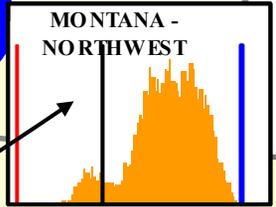
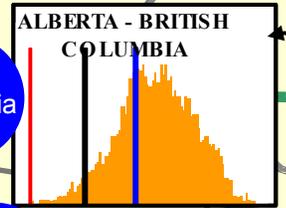
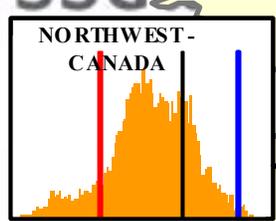
**Existing System**  
 Total Capacity in MW as of 1/1/00  
 Total MWs = 158,889  
 On Existing Transmission System





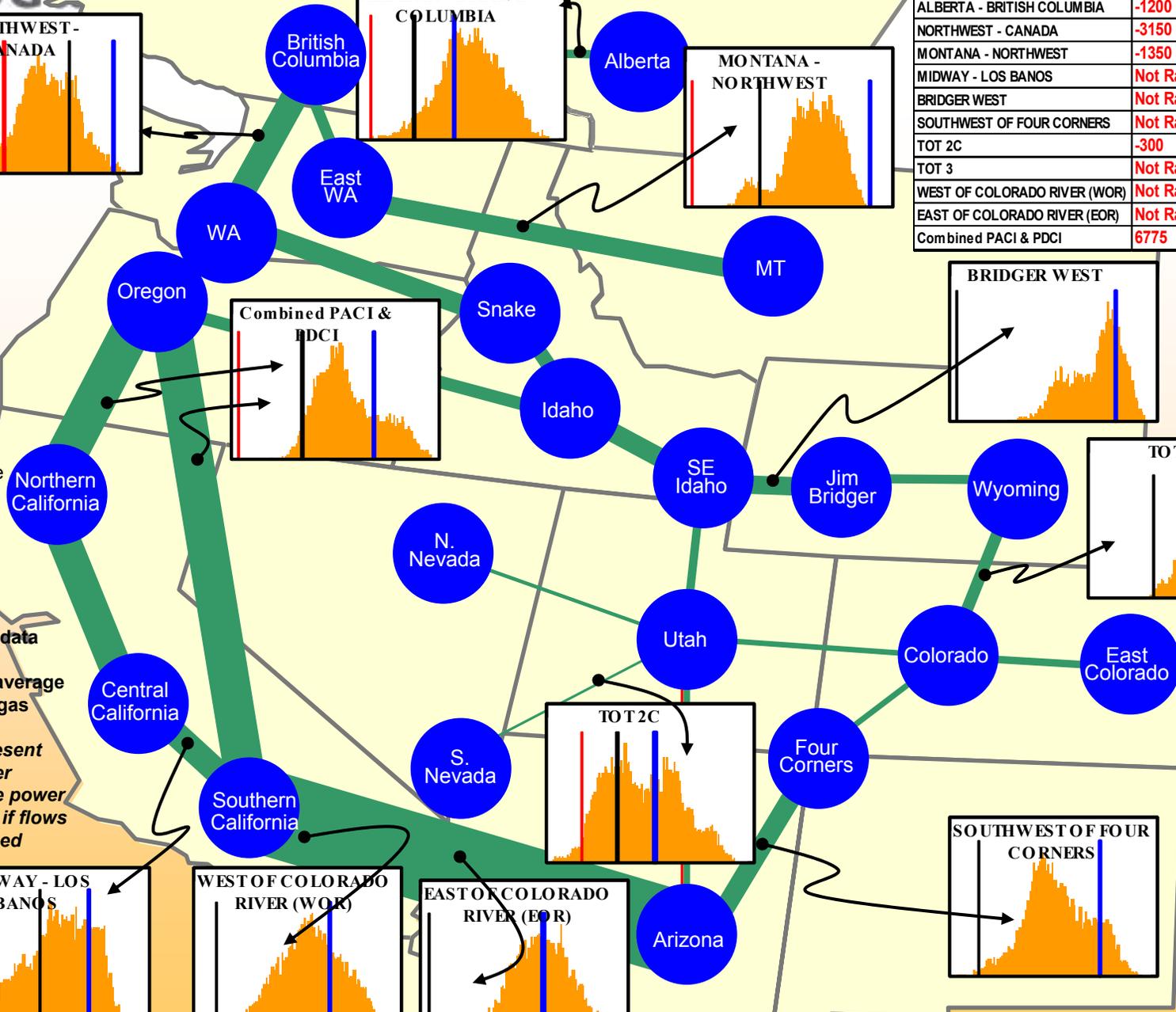
# Transmission Constrained Generation

Zero axis - black	Rev Limit	FWD Limit
	red	blue
ALBERTA - BRITISH COLUMBIA	-1200	1000 E to W
NORTHWEST - CANADA	-3150	2000 S to N
MONTANA - NORTHWEST	-1350	2200 E to W
MIDWAY - LOS BANOS	Not Rated	3900 S to N
BRIDGER WEST	Not Rated	2200 E to W
SOUTHWEST OF FOUR CORNERS	Not Rated	2325 E to W
TOT 2C	-300	300 N to S
TOT 3	Not Rated	1605 N to S
WEST OF COLORADO RIVER (WOR)	Not Rated	10118 E to W
EAST OF COLORADO RIVER (EOR)	Not Rated	7550 E to W
Combined PACI & PDCI	6775	7300 N to S

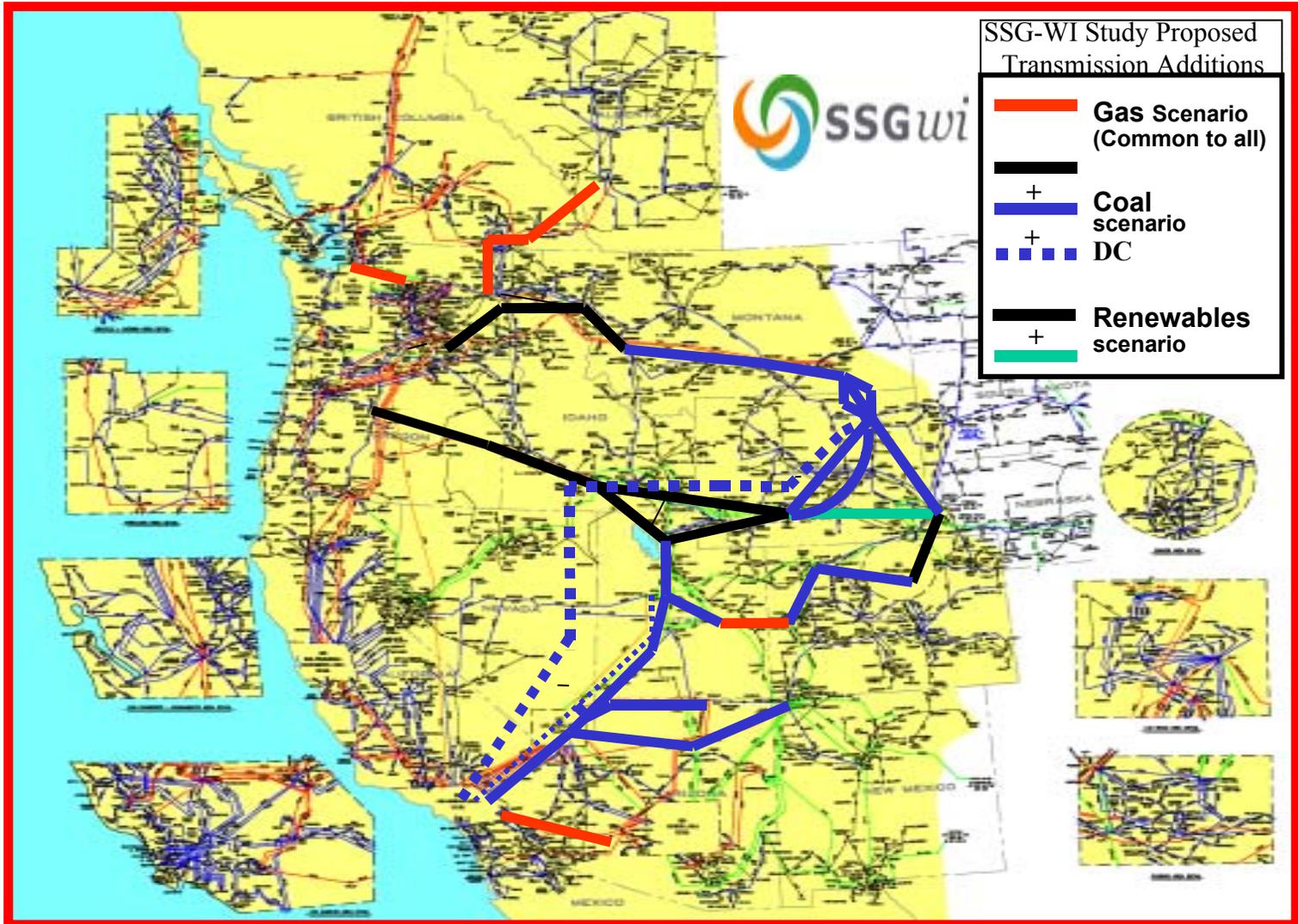


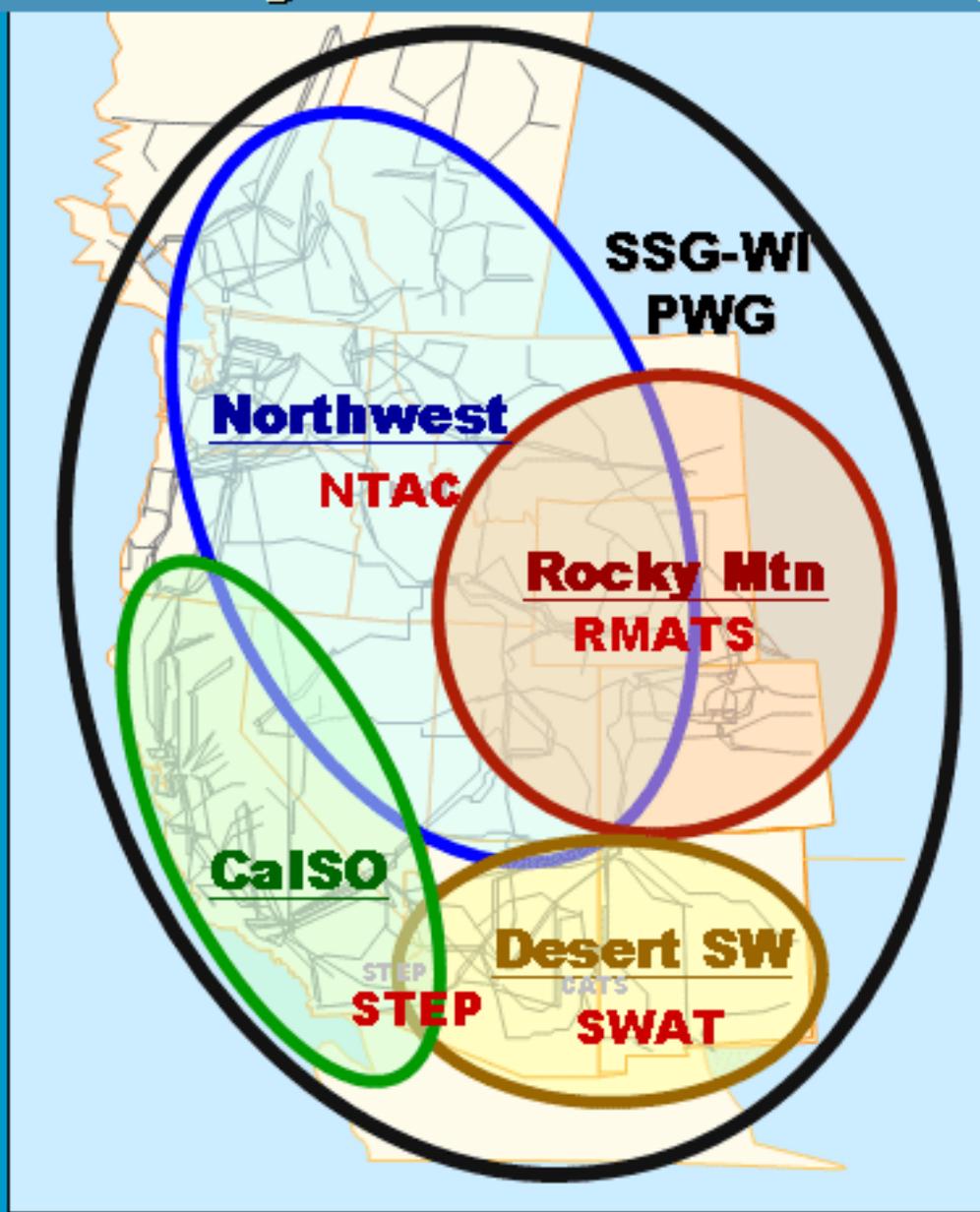
Vertical blue bars - indicate forward capacity limits & red bars indicate reverse capacity limits of path. Black bars indicate zero axis

Histogram flow data derived from unconstrained average water- medium gas 2008 scenario  
 Note: data represent theoretical upper bound on where power "wants" to flow if flows are unconstrained

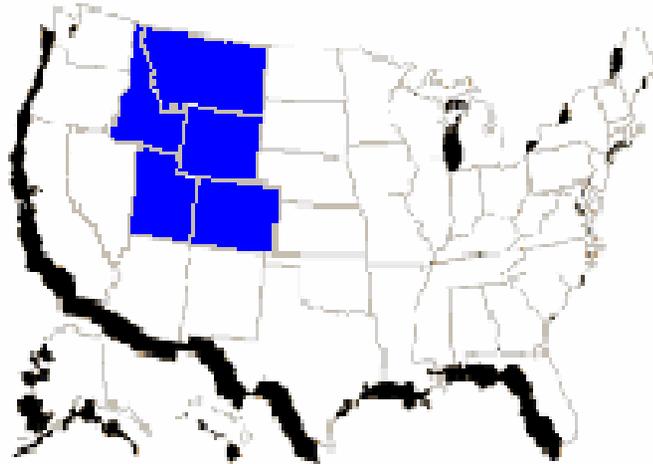


Background map courtesy of Western Electricity Coordinating Council





# **RMATS** - **Transmission Solutions**

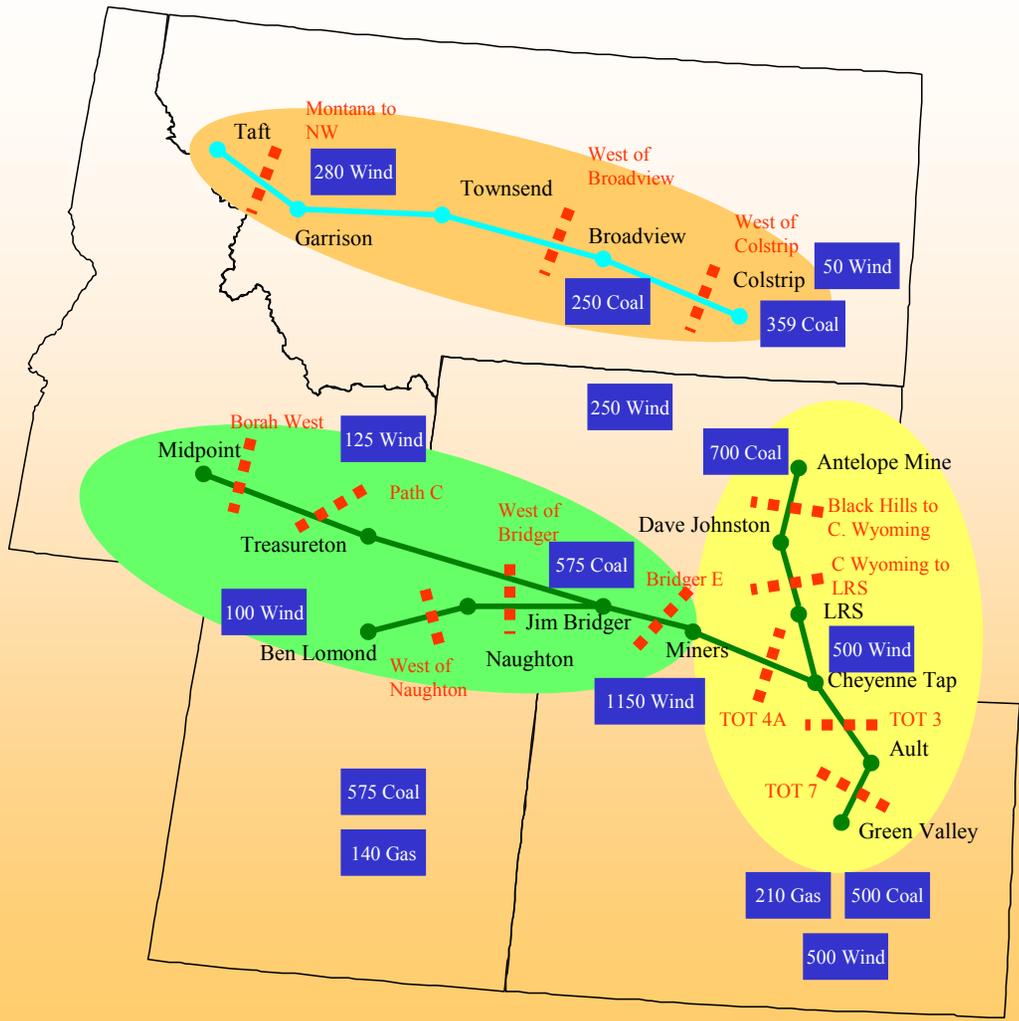


***Rocky Mountain Area Transmission Study***



# RMATS - Recommendation 1 Transmission Projects

- Modified Interface
- Added Resource
- Added 345 kV Line
- Added Series Compensation Only



Montana Upgrades

Bridger Expansion

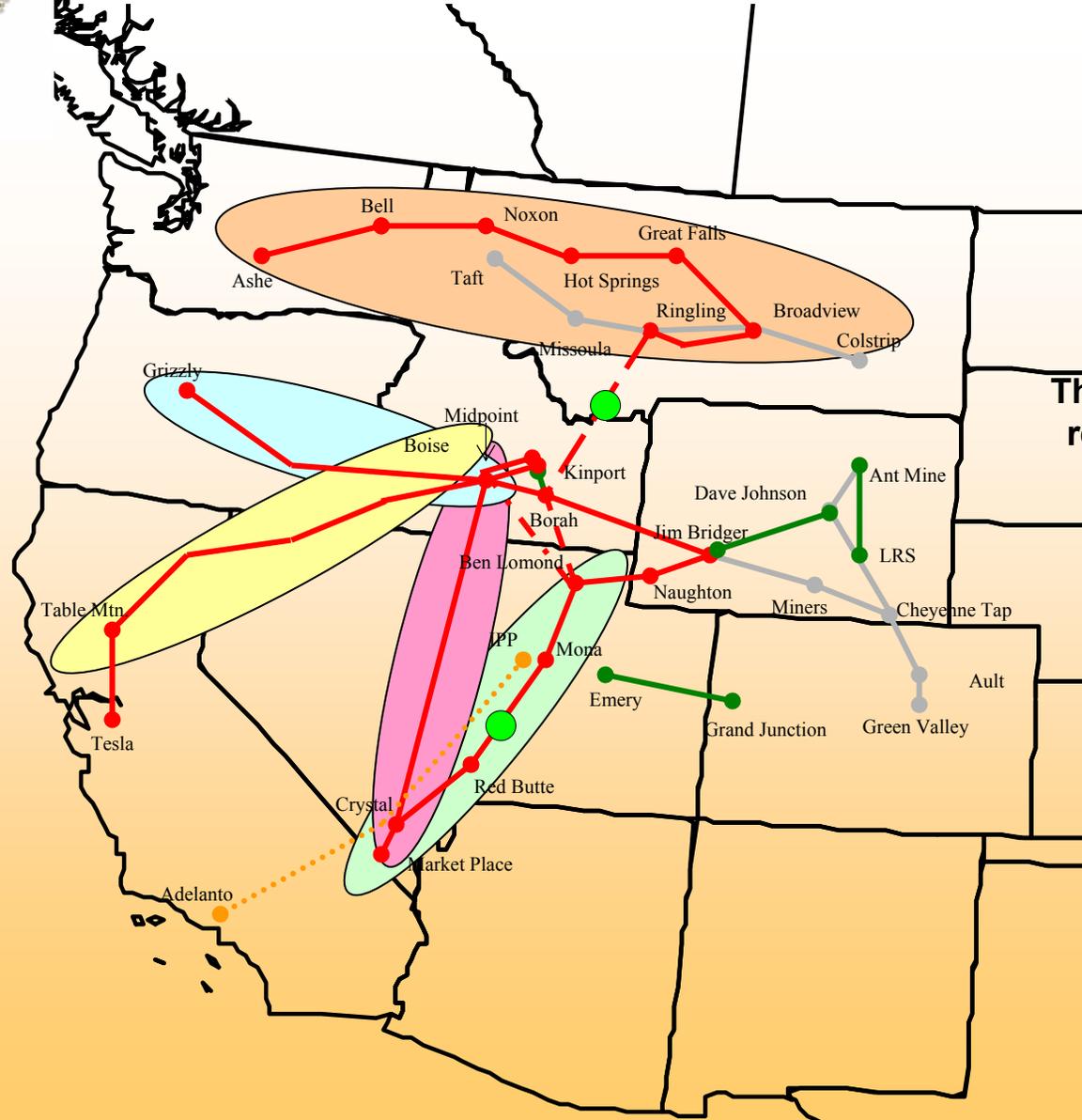
New WY- CO lines

# RMATS - Recommendation 2 Transmission Projects

## Longer-term export options



- 500 kV
- 345 kV
- ⋯ Additional DC
- Recommendation 1 facilities
- Added Phase Shifters
- - - Option 1 only
- - - Option 2, 3, & 4 only



**This export alternative requires two- 500 kV lines**

- Option 1**  
○ + ○
- Option 2**  
○ + ○
- Option 3**  
○ + ○
- Option 4**  
○ + ○

# Data for System Simulation



## Data required for identification of bottlenecks in the Western Grid

### – Historic data

- » reflects current drivers such as generation & load patterns, transmission operating practices, reliability standards, business & pricing practices, market structure
- » required to indicate where expansion is *possibly* needed & to benchmark models.

### – Input data & assumptions

- » For modeling & simulation studies
- » Needed to predict how the transmission grid will be loaded in future or assumptions change - load growth, new generation, fuel prices, usage patterns, business & market structures, & operating practices

### – Model output results

- » Predict future transmission loadings, congestion, reliability issues, locational prices & cost/benefit impacts
- » By aggregate and individual parties & sub-areas for cost/benefit allocation
- » Needed for expansion or operating decisions
- » Needed for policy & market design decisions

# Historic Data

- ◆ SSG-WI Historic Path Actual Loadings
  - Actual flows reflect result of schedules, netting, existing contractual rights, reservation limitations & business practices
  - Data is available for Critical Paths that have been identified as having past curtailment problems
- ◆ Schedules
  - Contract Path requirements & usually doesn't reflect loopflow
  - May be limiting on paths before actual loadings under present WECC operating practices
- ◆ OASIS Reservation Requests
  - Includes transmission needed to held open for reserves & backup

# Model Data for SSG-WI Study

- ◆ Scenarios & assumptions for future cases developed by the Technical Support Group - consensus
- ◆ Area load growth predictions
  - From participants, WECC, IRPs, & States
  - Local area diversities included
- ◆ Generation expansion levels & location scenarios from industry advocates of various resource types (including DSM)
- ◆ System transmission powerflow data
  - WECC Data (NERC Reliability Council)
  - Impedance & flow distributions, location of loads & generation, path ratings
- ◆ Public domain data using “typical data” from industry for market sensitive data
  - Unit heat rates, fuel prices, hydro output curves, transmission cost effects
- ◆ Resource Planning Margin of 15% for all scenarios
- ◆ RTO “Like” Market Structure without seams assumed

# Model Output Data

- Expansion Costs
  - Aggregate & individual
  - Generation & Transmission Capital
- Predicted individual hourly path loadings
  - Level & duration
- Generation performance & costs
  - Aggregate & individual
- Variable Operating & Maintenance costs
  - Fuel
  - Regional, local, individual for scenarios & benchmark
- Locational costs for energy delivered at load busses