Topics

- WECC Overview
- Transmission Expansion Planning at WECC
- Wind Modeling and Transmission Planning
What is WECC?

Hint: It’s not the Western Interconnection

Stats

- 14 states, 2 provinces, Baja CA
- 78 million people
- 230 GW of generation
- 122k miles of transmission
- HQ: Salt Lake City, UT
WECC Functions

WECC’s mission is to promote and foster a reliable and efficient bulk electric system

Non-Planning Functions
- Compliance Monitoring and Enforcement
- Standards Development
- Market-Operations interface
- Operator training
- WREGIS
- Reliability Coordination*

Planning Functions
- Loads and Resources Assessments
- Reliability studies
- Transmission Expansion Planning

Today’s Focus
Why is Transmission Planning Important?

Reliability

Policy

Economics

Environment

Tx Planning

Now

+10 Years

+20 Years
Transmission Planning in the West
[there is a lot of it]

Who

Footprint

Precision

Interconnection-Wide

Regional

Utility/LSE/IPD
Transmission Planning Software and Technology S-Curve

Performance

Time

PCM

Load Flow

Technology approaches physical limit

40 years!

Major technical obstacles overcome

LTPT
10-Year Studies
Production Cost Model

Security constrained + Economic dispatch

Hypothetical Resource Availability - Friday/Saturday
10-Year Studies
Lots of Wind and Gas Added

Generation Capacity Additions 2012-2022

Installed Resources
Gas  Hydro  Solar
Geothermal  Wind  Other

Scale (MW)
10,000 MW
5,000 MW
0 MW

Generation Addition Summary
WECC-wide 2012-2022

Gas  Wind  Solar  Hydro  Geothermal  Other

Added Capacity (MW)
0  5,000  10,000  15,000  20,000

Note: CC, CT, and Steam Boiler included in "Gas" category. "Hydro" includes large and small. "Other" includes biomass, IC, and Pumped Storage.
10-Year Studies
RPS Compliant Future

Percentage of 2022 Total Renewable Energy Generation by Type and State/Province

- Biomass RPS
- Geothermal
- Small Hydro RPS
- Solar
- Wind

Note: Mexico (CFE) = 3.7%
Texas (El Paso) = 0%

Percentage of Renewable Generation by Type

- Wind: 54%
- Geothermal: 20%
- Solar: 14%
- Biomass RPS: 8%
- Small Hydro RPS: 4%

2022 WECC Renewable Generation: 168,987 GWh
10-Year Studies
Transmission Assumptions are Key

2022 Common Case Transmission Assumptions (CCTA)

The purpose of the CCTA is to provide a basic set of transmission facilities that TEPPC can use as a starting point for their own studies. The CCTA is a list of facilities that have a high probability of being in service by 2022.

- Boardman-Hemingway (B2H)
- Cascade Crossing
- Central Ferry - Lower Monumental (Little Goose Area Reinforcement)
- Delaney - Palo Verde Line
- Delaney - Sun Valley Line
- Devers - Colorado River (DCR) Project
- Gateway Central Project: Mona to Quirrh (Segment C)
- Gateway Central Project: Sigurd - Red Butte
- Gateway South Project: Segment 2 (Aeolus - Mona)
- Gateway West Project: Segment 1A (Windstar to Jim Bridger)
- Gateway West Project: Segment 1B (Bridger - Populus single circuit)
- Gateway West Project: Segment 1C (Populus - Midpoint)
- Gateway West Project: Segment E (Midpoint - Hemingway)
- Hassayampa - North Gila #2 Line
- I-5 Corridor Reinforcement Project (Castle Rock - Troutdale)
- Interior to Lower Mainland Transmission (ILM) Project
- Montana Alberta Tie Project (MATL)
- Morgan - Sun Valley Line
- Midway-Waterton
- Path 8 Upgrade/Colstrip Transmission Upgrade (western portion only)
- Pawnee-Smoky Hill
- Pinal Central-Tortolita
- Pinal West-Pinal Central-Browning (SEV)
- San Luis Valley-Calumet-Comanche
- Sunrise Powerlink
- SWIP South
- Tehachapi Renewable Transmission Project
- Walla Walla to McNary (Energy Gateway Segment A)
- West of McNary Reinforcement Project Group 1 (McNary - John Day)
- West of McNary Reinforcement Project Group 2 (Big Eddy - Knight)

Subregional Coordination Group (SCG)

- CAISO - California Independent System Operator
- CTPG - California Transmission Planning Group
- CG - ColumbiaGrid
- CCGP - Colorado Coordinated Planning Group
- NTTG - Northern Tier Transmission Group
- SIERRA - Sierra Subregional Planning Group
- SWAT - Southwest Area Transmission
- AESS - Alberta Electric System Operator
- BCCPG - BC Coordinated Planning Group
10-Year Studies

Case Studies

Change in Total Cost ($M) to Achieve RPS-Compliance under High Loads
(comparison with PC1-5 High Load non-RPS compliant case)
20-Year Studies
New WECC “Long-Term Planning Tool”

Dataset (2032)

Tools
- Resource Optimization
- Transmission Analysis and Expansion

+ Capital cost assumptions
+ Water nexus
+ Environmental GIS
20-Year Studies
LTPT Capabilities

**Resource Additions**
- Wind: 56%
- Gas: 35%
- Solar: 3%
- Water: 1%

**Transmission Expansions**

**Line Bending**

**CO2 Production**

**Costs**

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**CO2 Production**

- **Data:**
  - 2022 Common Case
  - Reference Case
  - Scenario 1
  - Scenario 2
  - Scenario 3
  - Scenario 4

- **Chart:**
  - X-axis: Years
  - Y-axis: Amount of CO2

**Capital Costs and LCOE**

- **Data:**
  - Generation Capital Costs
  - Transmission Capital Costs
  - Weighted Average LCOE (No CO2)

- **Chart:**
  - X-axis: Scenarios
  - Y-axis: Costs (Millions of Dollars)
20-Year Studies

Renewables Added for Energy (not Policy)

2022-2032: Added Capacity
(by state and fuel in MW)

- Wind: 56%
- Gas: 35%
- Solar: 3%
- Water: 1%
- Gap: 5%

Added 57,000 MW from 2022-2032
20-Year Studies
Uncertainty Dominates

2022-2032 Additions: LCOE Supply Curve
(New Gens, WECC-wide)

Capacity Weighted Avg LCOE ($/MWH)

Cumulative Capacity Added (GW)

- Hydro
- Wind
- Combined Cycle (Gas)
- Alberta Gap
- Solar PV
- DG (Solar PV Rooftop)
20-Year Studies

Remote Resources = Transmission

Resources Added
2022-2032

- Wind: 56%
- Gas: 35%
- Solar: 3%
- Gap: 5%

Transmission Added
2022-2032

Region/BA boundaries are approximate and for illustrative purposes only. They are based on cross-referencing:
1) WECC BA Map as of 4/30/13
2) Publicly posted service territories of entities
3) Location of buses in TSS Case
4) Areas used in TEPPC 2012 PCM dataset
20-Year Studies
Future System Flexibility

Flexible Resource Indicator
= [Total Gas + 15% Total Hydro Capacity (MW)] / Total VG Capacity (MW)
What does WECC do with this analysis?
2013 Interconnection-Wide Plan

Key Messages

• Interconnection-wide perspective of the transmission system under a wide variety of futures
  o 10-Year: Bottom-up approach, impact of near-term decisions
  o 20-Year: Top-down, drivers of energy futures
• Stakeholder-driven and approved
• Informational, not instructions or orders
• Limitations in scope and intended uses
• The Plan and WECC’s reliability mission

Understanding the impacts of decisions, not determining what should be done
Wind and Transmission Planning

Key Considerations

Capital Cost

Generation Profiles

Performance Improvements
Questions?

Work for WECC
www.wecc.biz

2013 Interconnection-Wide Transmission Plan

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