Regional Integration of Renewables Kick-off Meeting

Assessment of Northern California Sub-Regional Renewable Transmission Integration Priorities Beyond 2010

Chifong Thomas
PG&E – RIR Lead

Dora Yen-Nakafuji,
CEC/PIER – Technical Lead Renewable Integration

Core Analysis Team:

CEC: Dora Yen-Nakafuji
CPUC: Brian Schumacher
CAISO: Gary DeShazo, Larry Tobias
SMUD: James Leigh-Kendall, Foung Mua, Joe Tarantino
PG&E: Kang Ling Ching, Ben Morris, Chifong Thomas
TANC: Larry Gilbertson, Brian Griess, Dave Larsen, 'Monte Meredith
WAPA: Mariam Mirzadeh, Morteza Sabet

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Agenda

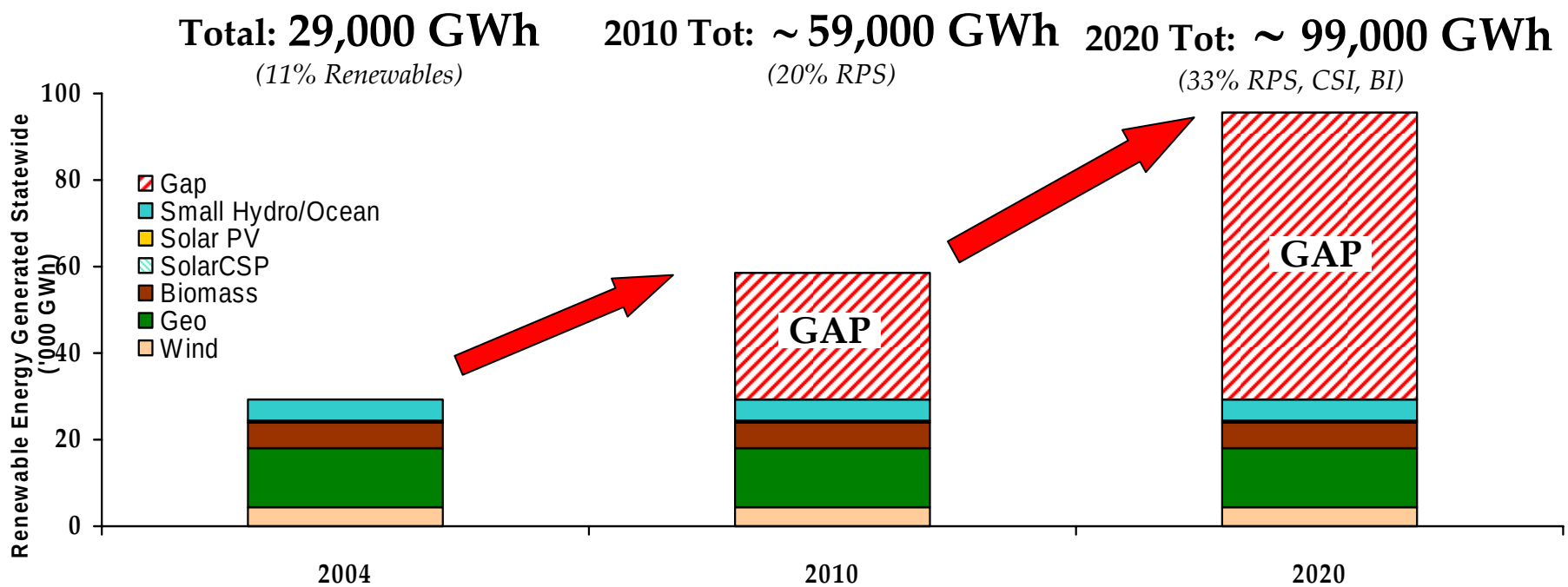
1. Background
2. Transmission under Consideration in WECC
3. Regional Integration of Renewables (RIR)
   a. Structure
      - Stakeholder Steering Committee
      - Core Analysis Team (CAT)
   b. Renewable resource information
      - CEC Reports & other Statewide, Regional & Local studies
      - Stakeholder Input
   c. Study Scope
   d. Methodology
   e. Deliverables
   f. Schedule
4. Q and A

CA Integration Challenges
Policy, Market & Technology Drivers

- Policy: RPS and accelerated Goals for 2010 and 2020 targets
- Market: *Wind and geothermal* resources are anticipated to be the largest contributors to meeting the RPS (kWh)
- Transmission Grid: System & operational changes to accommodate higher levels of renewables
  - Resource planning (infrastructure, models)
  - System reliability (regulation, load following, reserves, ramping)
  - Control & dispatch (process, tools)

Motivation: Projected RPS Needs

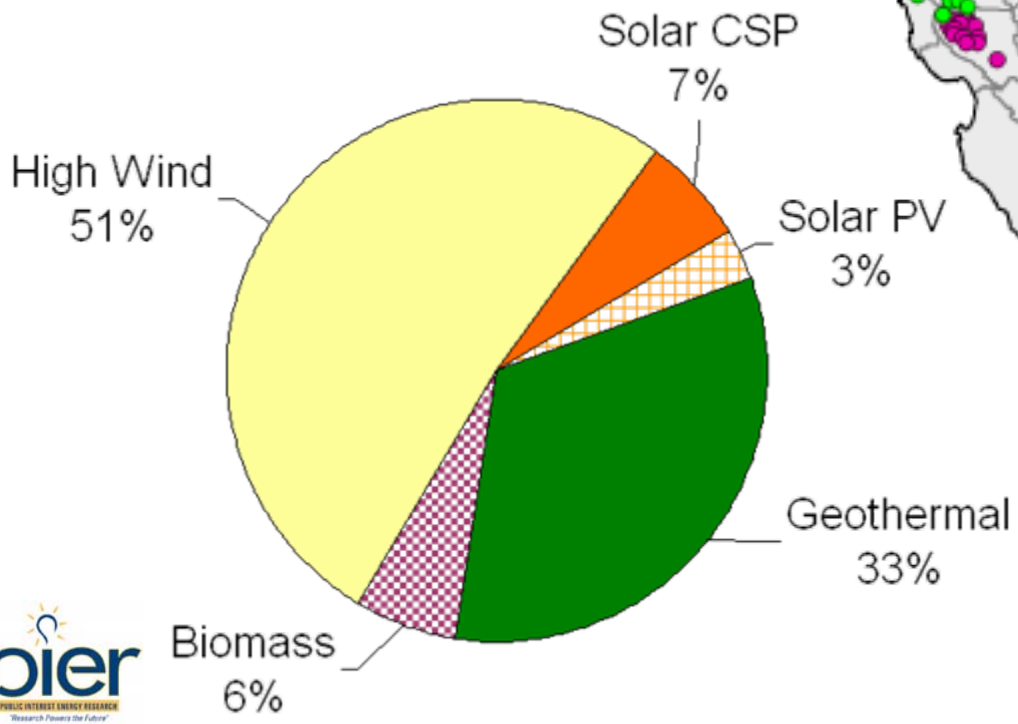
Projected Renewables to Meet California Policy Goals

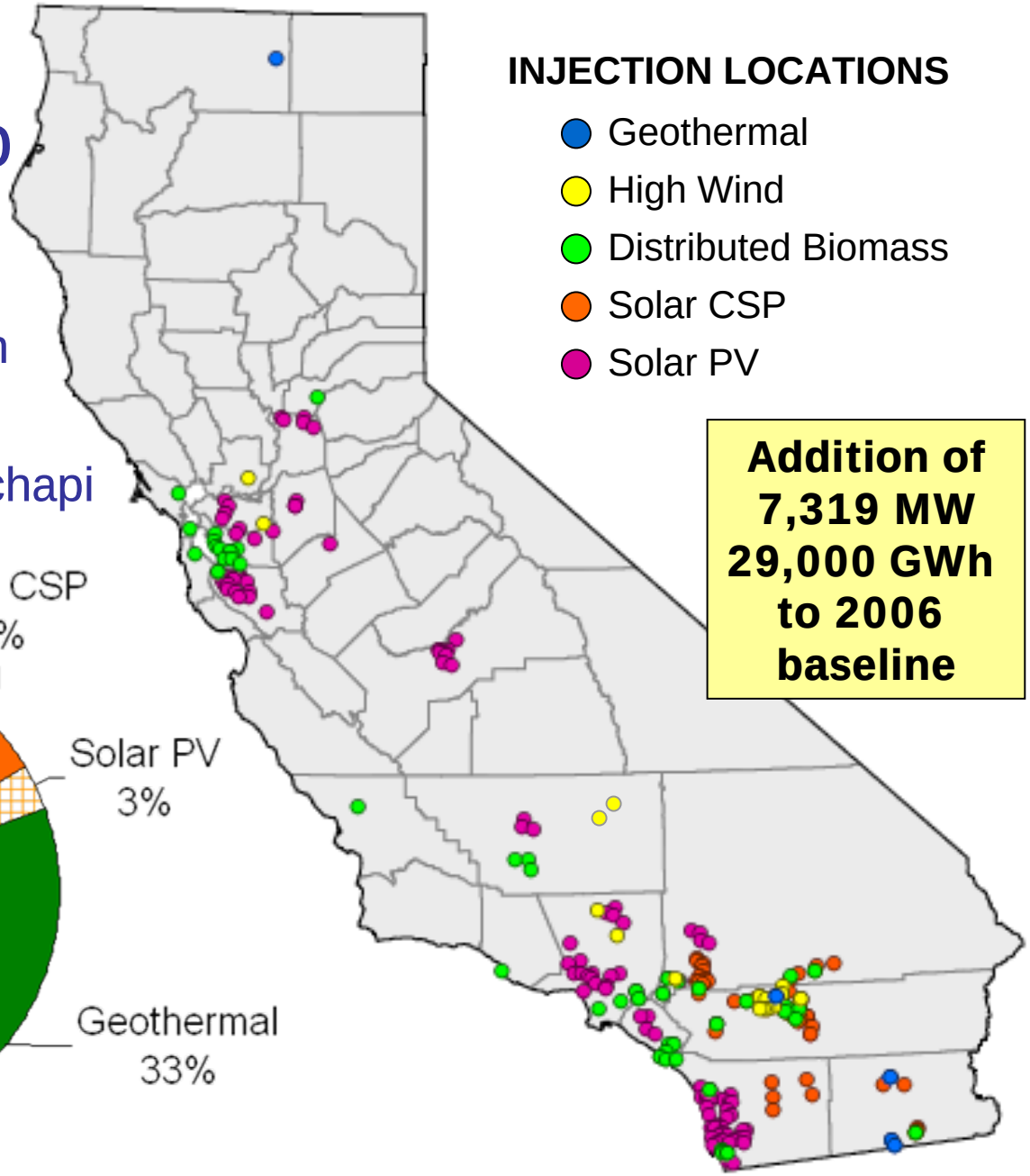


Data Sources: 2004, CEC Electricity Report which includes all renewables in the State, not just IOUs; 2010 and 2020, PIER Renewables Projections.

2010 Scenario

- 20% renewable generation
- Portfolio mix of resources
- 3000 MW of wind at Tehachapi



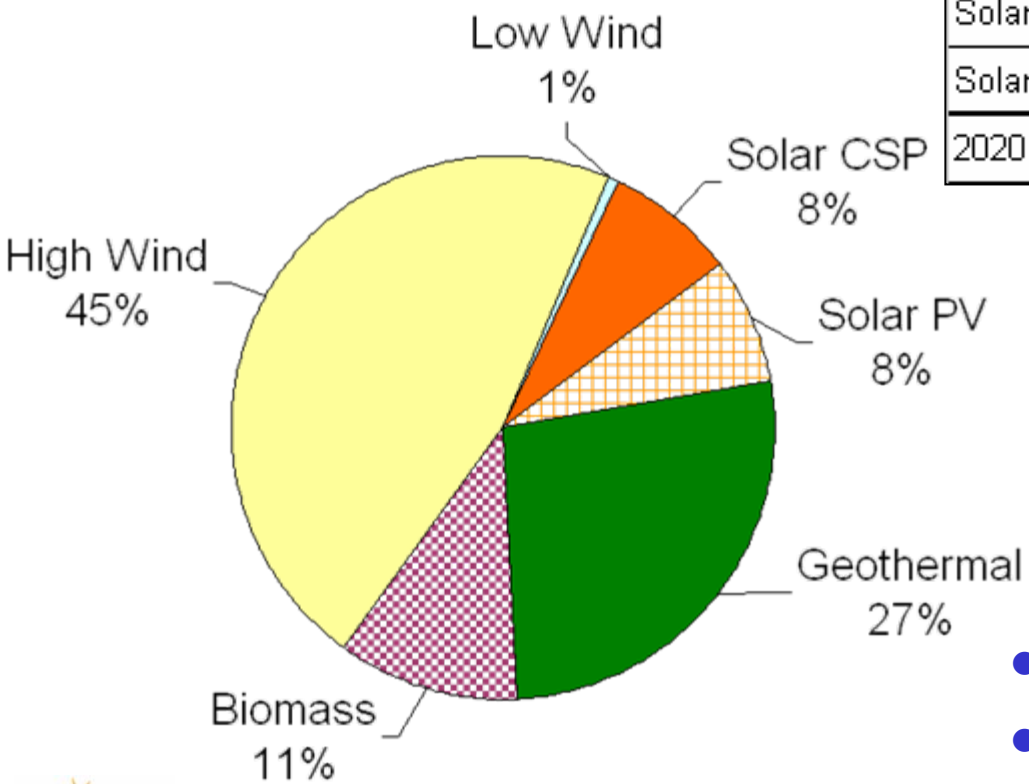


Addition of 7,319 MW 29,000 GWh to 2006 baseline

2020 Scenario

Technology	MW	CF%	Energy (GWh)
Geothermal	2,385	90%	18,803
Biomass	980	89%	7,669
High Wind	9,961	37%	32,286
Low Wind	181	25%	396
Solar CSP	2,650	27%	5,442
Solar PV	3,000	20%	5,256
2020 Net Add-on	19,157		69,852

Preliminary



Addition of 19,157 MW 69,852 GWh to 2006 baseline

- 33% renewable generation
- Portfolio mix of resources

Statewide Objectives

- Focus on statewide transmission *planning options* to help meet policy objectives
- Focus on providing *quantitative impacts* (pros & cons) of various options on transmission reliability, congestions and mix of renewable technologies
- Develop *tools and analysis methods* to evaluate renewables along with conventional generation
- Provide a *common perspective* for evaluating different technologies competing for limited system resources
- Provide a *common forum* for Commissions, utilities and developers to examine the location and timing of new generation/transmission projects and public benefits of these resources

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IAP - A Piece of the Puzzle

- A number of existing transmission planning & renewable integration activities within state, WECC and nation (e.g. CaISO, Tehachapi, Imperial, utility studies)
- Require coordinated national, state and industry effort to find a “fitting” solution

Time Scales for System Planning and Operation Processes

Slower (Years)

Time Frame

Faster (seconds)

Long-Term Resource and Capacity Planning

Capacity Value

Unit-Commitment

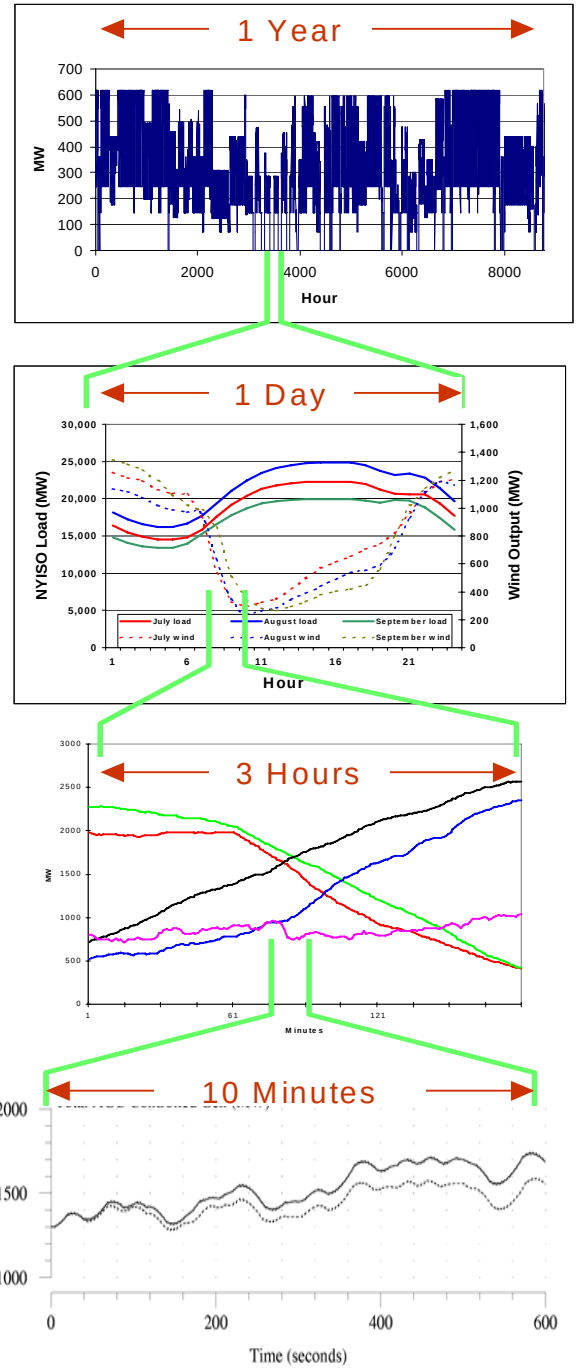
Day-Ahead Scheduling

Multi-Day Forecasting

Load-Following
(5-minute dispatch)

Hour-Ahead Forecasting

Frequency and Tie-Line Regulation (AGC)



Other Renewable Integration and Transmission Projects

- Tehachapi/Imperial Working Group
  - Facilitate development of transmission alternatives for wind resources
- Intermittency Analysis Project (IAP)
  - 2010 and 2020 renewable mixes
  - Quantify impacts of variability
- Utility Concerns & Operating Impacts
  - Operator interviews
  - Matrix of recommended transmission study areas
- Federal Transmission Corridors Study
- RETI Phase I

IAP Project Tasks

- Impact of Past, Present & Future Wind Technologies on Transmission & Operation Report
- Four Study Scenarios
  - 2006 Base Case
  - 2010 Tehachapi with 3,000MW of wind in Tehachapi
  - 2010 Accelerated Case: theoretical “stepping-stone” case for building to 2020 alternatives
  - 2020 Case – 33% penetration
- Lessons Learned from the International Experience - Europe and Asia

Next Steps: Sub-Regional Focused Studies

- Leverage statewide studies and scenarios to develop transmission strategies specific to utility needs, regional resources and transmission priorities
- Support utility-led efforts to study renewable integration and transmission reliability impacts to California

RIR - Structure

- Project Advisory Committee (PAC)
  - All Interested Stakeholders
    - monthly conference calls
    - Public workshops

- Core Analysis Team (CAT)
  - CEC: Dora Yen-Nakafuji
  - CPUC: Brian Schumacher
  - CAISO: Gary DeShazo, Larry Tobias
  - SMUD: James Leigh-Kendall, Foung Mua, Joe Tarantino
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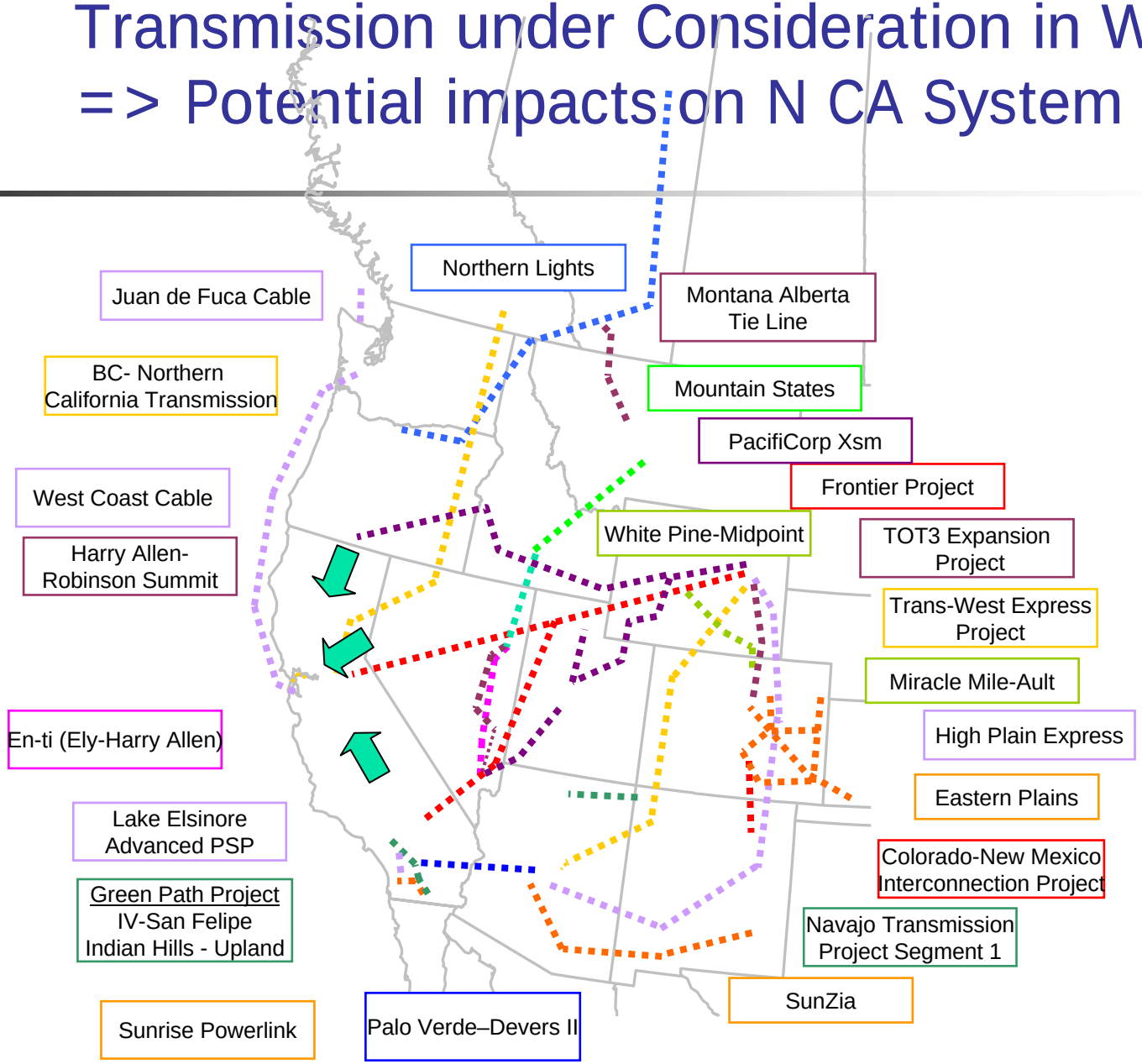
Transmission under Consideration in WECC => Potential impacts on N CA System



RIR - General Concept

- Laying a solid technical basis for Renewable Integration
  - Conceptual transmission
  - System reliability across multi-utility service areas
  - Preliminary route and engineering studies for cost estimates
- Will not cover:
  - Contractual issues
  - Cost Allocation
  - Commercial arrangement

Vision (Flexible Options) for Long-term Transmission for California

- Reliably serve Load
- Lowest possible cost to Customers in an environmentally responsible manner
- Enhance Market Efficiency, reduce Congestion where cost effective
- Connect Renewable Resources
- Maintain flexibility in developing transmission plans
- Address GHG & planning retirements of older units

Objective

- Facilitate proactively planning the transmission system to support customer loads
  - in advance of availability of specific resource information and
  - beyond the confines of single transmission owners in Northern California for 2015 - 2020 and beyond.

Structure

- Stakeholder Steering Committee
  - Monthly conference calls
  - Stakeholder meetings
- Core Analysis Team
  - Contribute Staff, Conduct studies
  - Currently – CEC, CPUC, ISO, PG&E, SMUD, TANC, WAPA

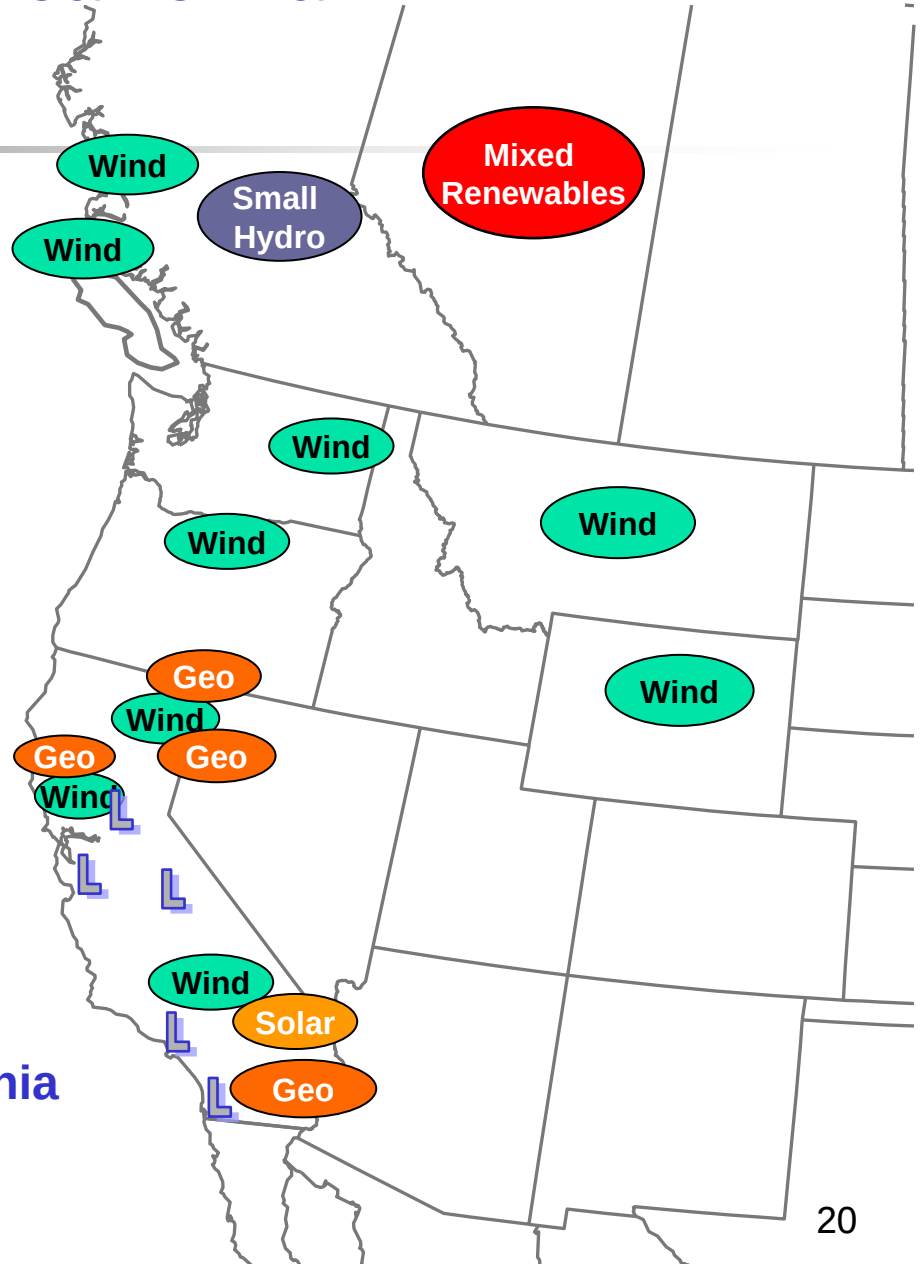
Study Data & Technical Information

- Network Topology and Load
  - Based on latest available WECC and CAISO base cases
  - Renewable resource locations
- Resources information
  - CEC Reports & other Statewide, Regional & Local studies
  - Stakeholder Input

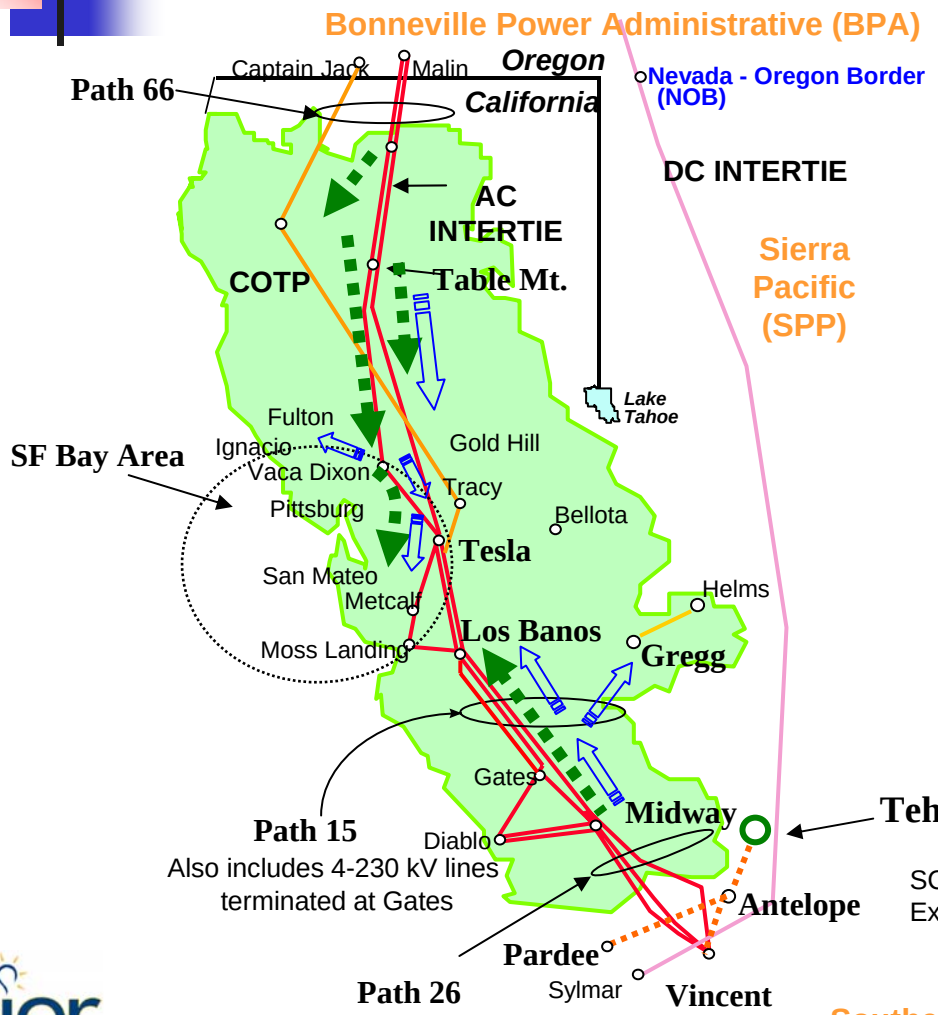
Potential Renewable Resources in WECC and Major Load Centers in California

- Alberta mixed Renewables
- B.C. Wind and Small Hydro
- Geysers Geothermal
- Mojave Solar
- Montana Wind
- N.E. California, Oregon, Nevada Geothermal and Wind
- Pacific NW Wind
- Salton Sea Geothermal
- Solano County Wind
- Tehachapi Wind
- Wyoming Wind

L -- Major Load Centers in California



Promoting Multi-purpose Transmission Projects to Reduce Customer Risk/Increase Customer Benefits



Existing Path Ratings

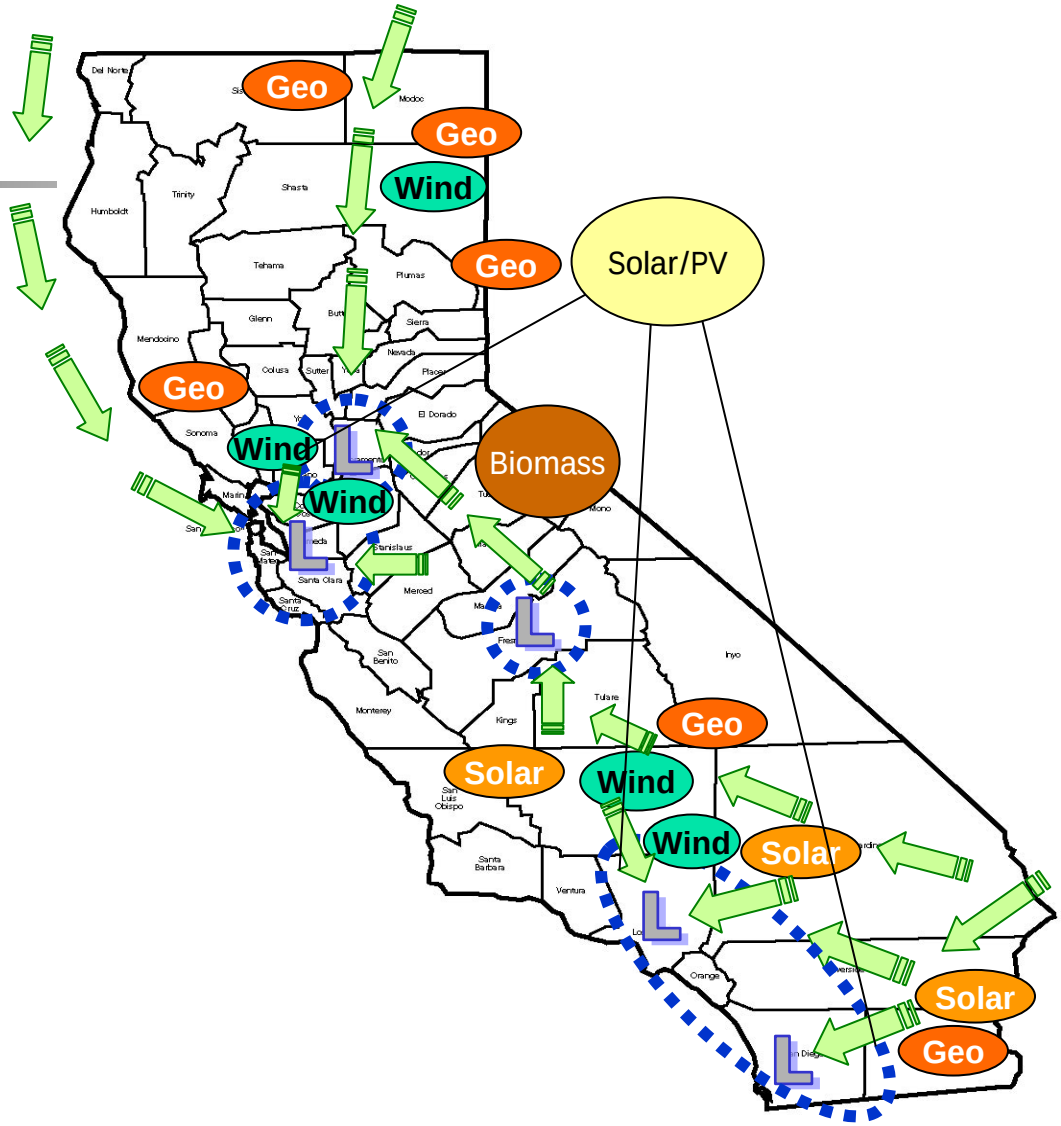
	North-to-South (MW)	South-to-North (MW)
Path 66	**4,800**	**3,675**
Path 15	**3,265**	**5,400**
Path 26	**4,000**	**3,000**

Corridors identified in Transmission Expansion Plan

Corridors identified in Transmission Ranking Cost Report

SCE's Tehachapi Phase 1 Projects + Further Expansion depending on study

Possible Future Transmission Corridors in California



Proposed Methodology

- Develop resource scenarios based on sound transmission planning principles to supply projected demand in California based on information available (i.e. CaISO, CEC, other transmission working groups and the WECC for 2015 - 2020 and beyond)
- Develop transmission planning base cases covering peak (summer) and off-peak (winter) and other seasons as necessary (light spring).
- Develop transmission options for each resource scenario to supply projected load
- Analyze each option using transmission planning programs to develop conceptual transmission upgrades
- Identify the transmission upgrades that are common to more than two resource scenarios

Proposed Methodology - continued

- Run sensitivity with projected load increased and decreased by X%
- Consider impact of varying climate conditions if applicable (i.e. hydro variation, carbon footprint reductions)
- Develop reconnaissance-level cost estimates for each transmission upgrade
- Rank the transmission upgrades based on:
  - Its estimated cost
  - Its ability to support the most economic scenarios
  - Its ability to support large number of resource scenarios
- Develop preferred ranking of transmission upgrades

Schedule

❑ Determine scenarios and base case preparation:	3 - 4 months
❑ Identify transmission problems:	1 month
❑ Formulate potential solutions:	3 - 4 months
❑ Preliminary check and cost estimate including engineering/land	6 - 9 months

Questions?