

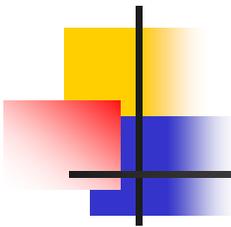
Intermittency Analysis Project: 2010 Scenario

Dora Yen-Nakafuji,
Commission Project Manager

Kevin Porter,
IAP Team Lead

CEC PIER Staff Workshop
August 15, 2006
Sacramento, CA



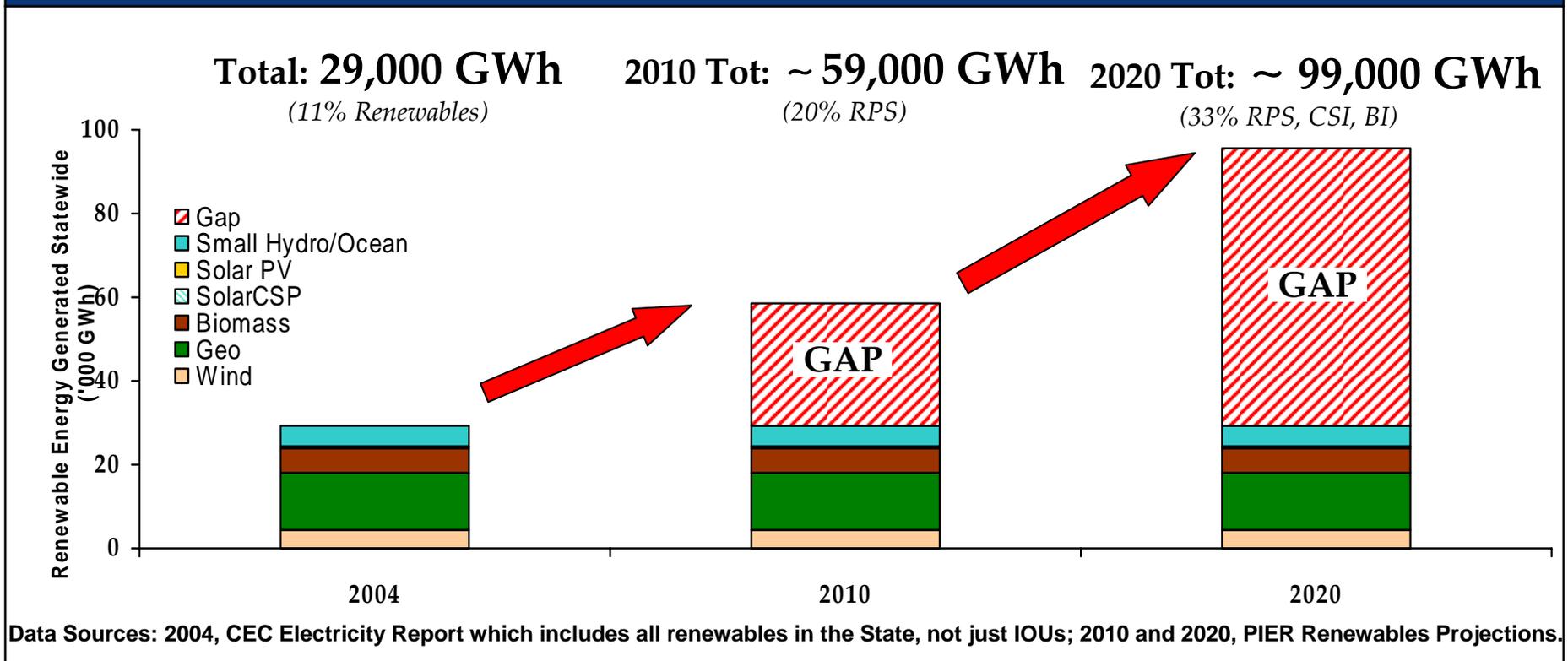


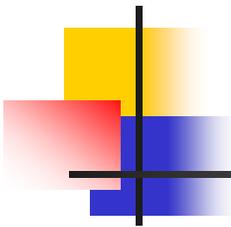
Agenda

- 9:00-9:15 am Welcome & Introductions – *Yen/Porter*
- 9:15-10:00 am Transmission Planning CaISO Perspective – *Darius Shirmohammadi*
- 10:00-12:15 Transmission Simulation – *DPC Team*
- 12:15-1:15 pm Lunch
- 1:15-4:00 pm Projected 2010 Impacts – *GE Team*
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- 4:45-5:00 pm Next Steps & Feedback – *Yen/Porter*

Projected RPS Needs

Projected Renewables to Meet California Policy Goals





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
- 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)

High Priority Topics

Commission IEPR recommendations - CERTS 5/2005

Define Attribute Requirements

- Define what is needed
- Develop appropriate metric
- Monitor performance

Reduce Uncertainty

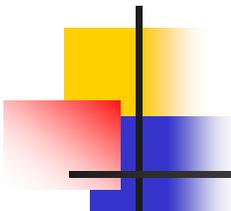
- Reduce scheduling lead time
- Improve data availability
- Improve metering, monitoring and forecasting techniques

Resource Policies

- Appropriate resource mix
- Dispatch priority for both Internal and Imported resources
- Load participation
- Coordinated use of available storage

Improve Planning and Modeling

- Resource deliverability
- Import capability
- Improve models
- Perform off-peak contingency analysis
- Coordination with other WECC members and states



IAP Focus

Define Attribute Requirements

- Renewable generation performance curves
- Renewable resource potential & locations
- New technology attributes

Reduce Uncertainty

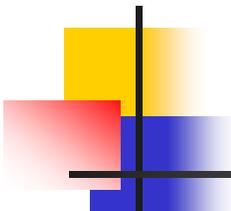
- Consistent statewide datasets
- Generation & load for multi-years
- Transmission datasets

Resource Policies

- Mix including renewables and conventional
- Perspective on generation to load centers
- Mitigation/storage options
- Lessons learned (world-wide experience)

Improve Planning and Modeling

- Quantified impacts
- Confidence in modeled options
- Expanded options and contingencies



IAP Objectives



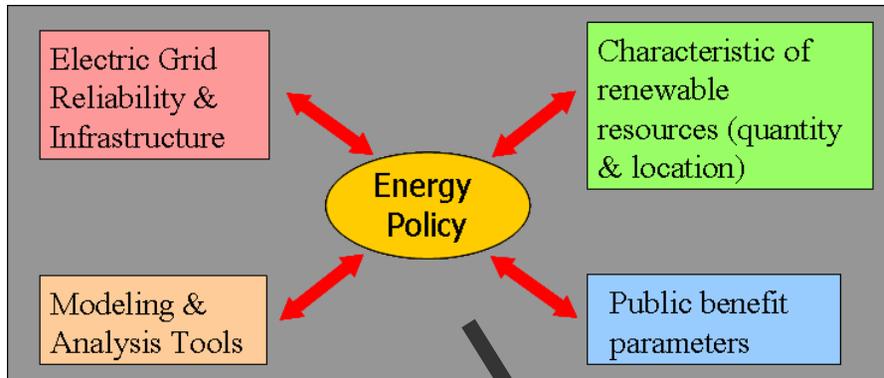
- Focus on statewide transmission planning options to meet policy
- Focus on providing quantitative impacts (pros & cons) of various options on transmission reliability, congestions and mix of renewable technologies
- Develop tools and analysis methods to evaluate renewables along with conventional generation
- 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

IAP - A Piece of the Puzzle



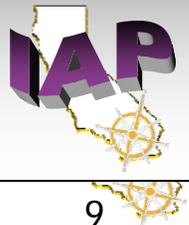
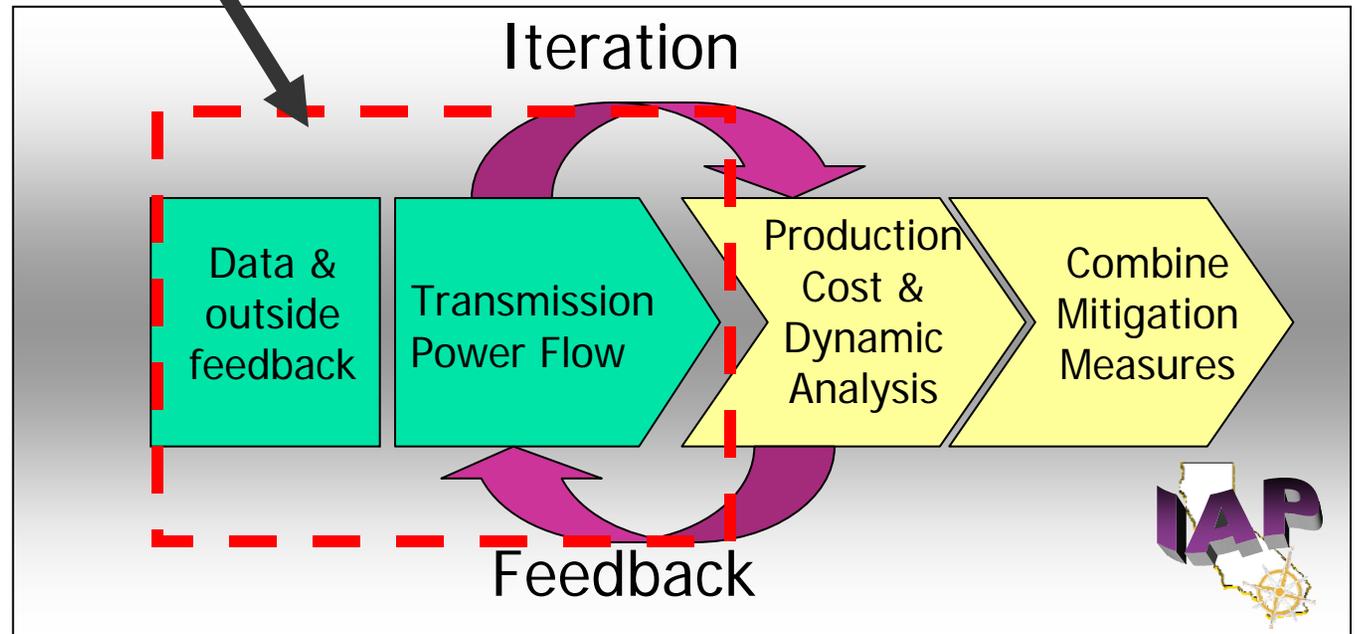
- A number of existing transmission planning & renewable integration activities within state, WECC and nation (i.e. [CaISO](#), [Tehachapi](#), [Imperial](#))
- Require coordinated national, state and industry effort to find a “fitting” solution

Impact on Operation - IAP



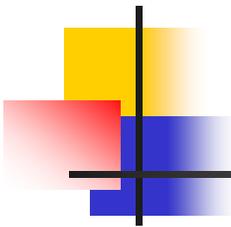
Transmission & Resource Planning

Operational Response & Grid Reliability Management



Project Core Analysis Team

Analysis Team	Company	Activity
Kevin Porter	Exeter Associates	Team Lead; World-wide Experience
Bill Erdman; Kevin Jackson	BEW Engineering; Dynamic Designs	Wind Turbine Technology
DPC Team	Davis Power Consultants; PowerWorld Corporation; Anthony Engineering	Transmission Planning, Power Flow Analysis
GE Team	GE Energy; AWS Truewind; Rumla Inc.	Production Cost Analysis, Statistical Analysis, Wind Forecast and Data
Henry Shiu, Case van Dam, Michael Milligan, Brendan Kirby	California Wind Energy Collaborative (UC Davis); NREL; Oak Ridge National Lab	Data Support, Technology Characteristics, Integration Costs

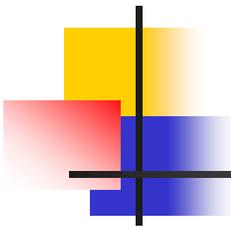


External Communication & Coordination

- Have relied extensively on data and guidance from utilities, renewable energy companies and CA ISO
 - Particularly helpful in shaping 2010 Tehachapi Case
- Monthly calls to provide updates on IAP project and to receive feedback
 - Next one is August 29th at 1:00 Pacific (see Kevin for details)
- Post-workshop comments on IAP Project may be filed with CEC by September 1st, 2006

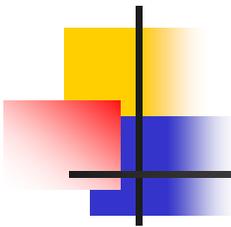
Utility Advisory Team

Organizations	Focus
CPUC, CEC	Policy, market, R&D
CaISO	Market, operations
Utilities	Data & operations for CA including PG&E, SCE, SDG&E, Municipals (SMUD, LADWP, IID)
CEERT, CERTS, UWIG	Tehachapi/Imperial Working Groups & Renewable Integration Studies
DWR	Water resources



Status of IAP Project

- Impact of Past, Present & Future Wind Technologies on Transmission & Operation Report - completed and posted on Commission website
- Workshop today - present preliminary results of 2006 Base Case and 2010 Tehachapi Case
- Two Remaining Cases
 - 2010 Transmission Constrained Case
 - 2020 Case – 33% penetration (discussion in afternoon)
- Draft of Report on Lessons Learned from Europe and Asia in development



IAP Project Schedule

- Fall 2006 – Report on Lessons Learned from Europe and Asia
- Preliminary results
 - 2010 Transmission Constrained
 - 2020 Cases by Late November
- December06/January07 – Next Commission IAP Workshop Final Results
- January/February 2007 – Final Report

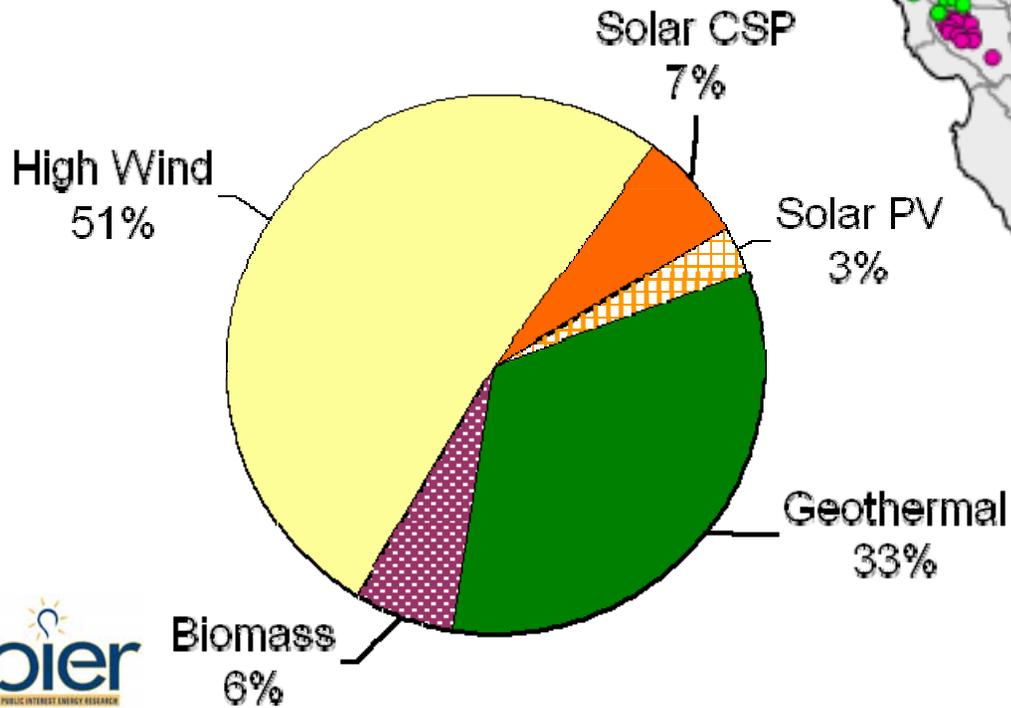
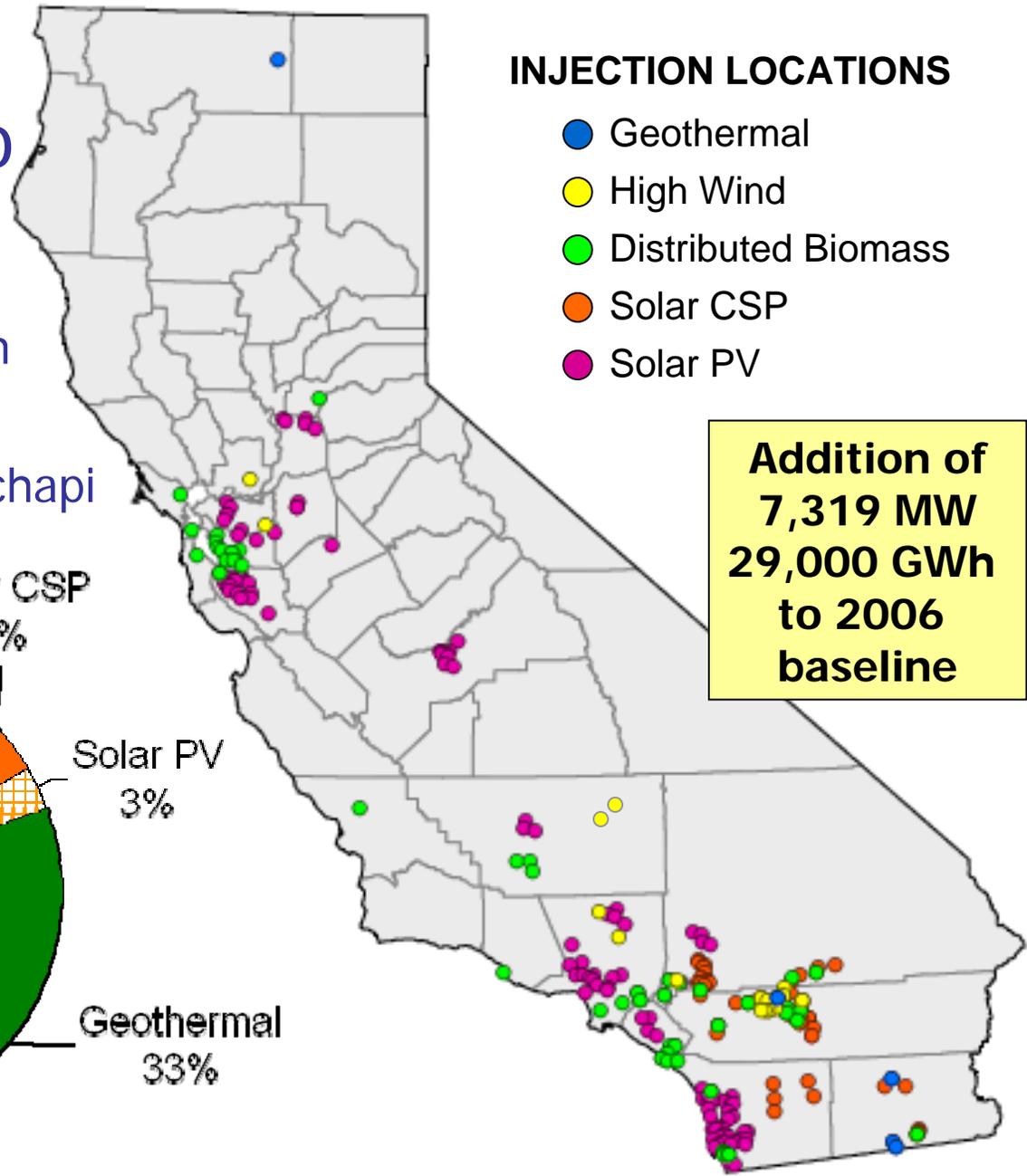
2010 Scenario

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

INJECTION LOCATIONS

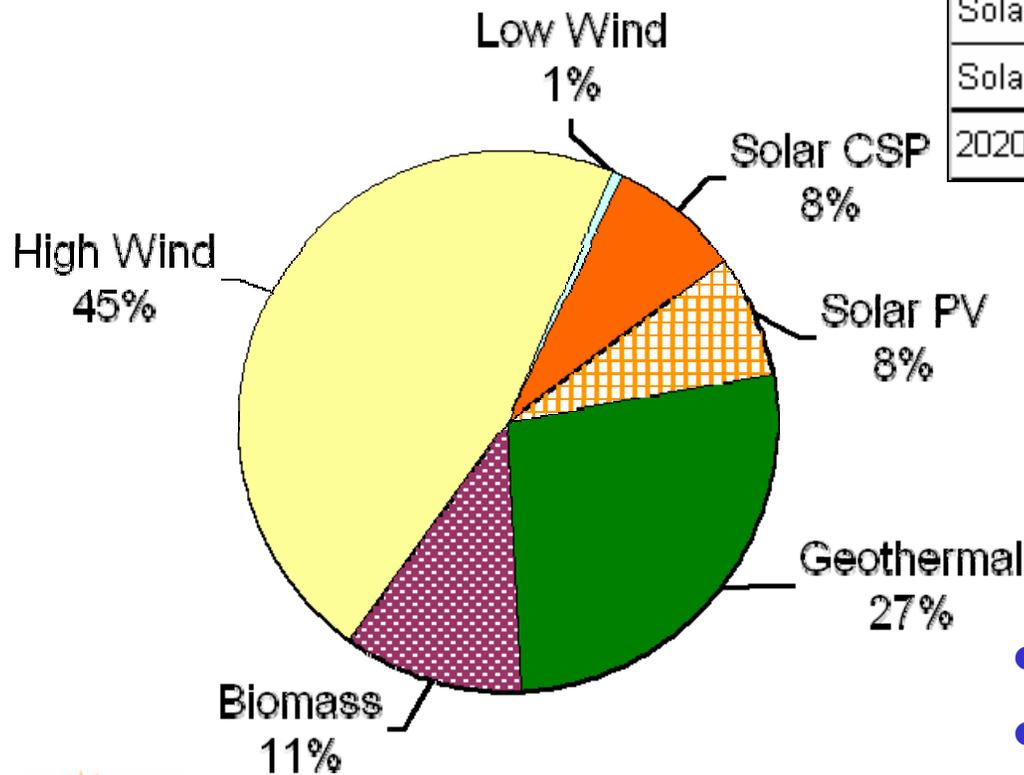
- Geothermal
- High Wind
- Distributed Biomass
- Solar CSP
- Solar PV

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



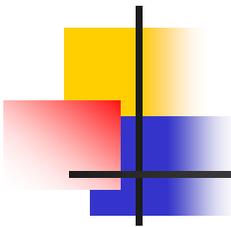
2020 Scenario

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



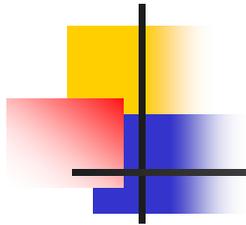
**Addition of
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- 33% renewable generation
- Portfolio mix of resources

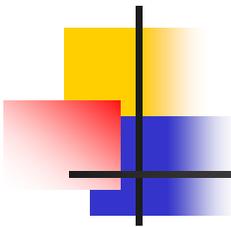


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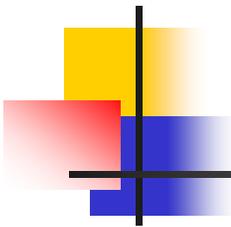


August 15th IAP Workshop Closing Slides



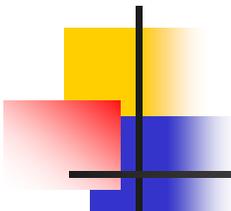
IAP Effort Summary

- Complete 2020 power flow modeling for integrated renewable portfolio scenarios
- Complete production cost modeling to determine operational & grid impacts 2010 and 2020
- Continue working with utility advisory team to evaluate mitigation strategies dealing with variable resources
- Foster cooperative interaction among key players to meet statewide objectives/policy targets and ensure reliable electrical supply
- Provide quantitative feedback supporting statewide energy planning and future transmission planning
- Present findings at public workshops



Discussion Questions

- Input on 2020 33% penetration scenario and higher penetration scenario?
 - Are current values and locations representative?
 - Are there other areas to consider?
- Perspectives on regulatory and market considerations?
- Perspective on sub-regional planning needs?
- Difference in resource mix by utility area?
- Suggestions on mitigation strategies?
 - Storage, technologies
 - Other management strategies
- Lessons learned?



Thank you

- Please provide questions & comments by Sept 1, 2006
 - Send to Peter Spaulding pspauldi@energy.state.ca.us and include "IAP Comments Aug 15" in header
- All workshop materials will be posted on Commission website
- For more information:
 - Commission contact: Dora Yen-Nakafuji dyen@energy.state.ca.us
 - Project lead: Kevin Porter porter@exeterassociates.com