Agenda

- 9:00-9:15 am  Welcome & Introductions – Yen/Porter
- 9:15-10:00 am  Transmission Planning Cal SO Perspective – Dariush 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
- 4:00-4:45 pm  Discussions, Q&A – All
- 4:45-5:00 pm  Next Steps & Feedback – Yen/Porter
Projected RPS Needs

Projected Renewables to Meet California Policy Goals

Total: 29,000 GWh  (11% Renewables)  
2010 Tot: ~ 59,000 GWh  (20% RPS)  
2020 Tot: ~ 99,000 GWh  (33% RPS, CSI, BI)

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

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

<table>
<thead>
<tr>
<th>Organizations</th>
<th>Focus</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPUC, CEC</td>
<td>Policy, market, R&amp;D</td>
</tr>
<tr>
<td>Cal SO</td>
<td>Market, operations</td>
</tr>
<tr>
<td><strong>Utilities</strong></td>
<td>Data &amp; operations for CA including PG&amp;E, SCE, SDG&amp;E, Municipals (SMUD, LADWP, IID)</td>
</tr>
<tr>
<td>CEERT, CERTS, UWIG</td>
<td>Tehachapi/Imperial Working Groups &amp; Renewable Integration Studies</td>
</tr>
<tr>
<td>DWR</td>
<td>Water resources</td>
</tr>
</tbody>
</table>
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

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

<table>
<thead>
<tr>
<th>Technology</th>
<th>MW</th>
<th>CF%</th>
<th>Energy (GWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geothermal</td>
<td>2,385</td>
<td>90%</td>
<td>18,803</td>
</tr>
<tr>
<td>Biomass</td>
<td>980</td>
<td>92%</td>
<td>7,669</td>
</tr>
<tr>
<td>High Wind</td>
<td>9,961</td>
<td>37%</td>
<td>32,286</td>
</tr>
<tr>
<td>Low Wind</td>
<td>181</td>
<td>25%</td>
<td>396</td>
</tr>
<tr>
<td>Solar CSP</td>
<td>2,650</td>
<td>27%</td>
<td>5,442</td>
</tr>
<tr>
<td>Solar PV</td>
<td>3,000</td>
<td>20%</td>
<td>5,256</td>
</tr>
<tr>
<td><strong>2020 Net Add-on</strong></td>
<td><strong>19,157</strong></td>
<td></td>
<td><strong>69,852</strong></td>
</tr>
</tbody>
</table>

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

**TOPIC FOR FURTHER DISCUSSION IN AFTERNOON**
Agenda

- 9:00-9:15 am  Welcome & Introductions – Yen/Porter
- 9:15-10:00 am Transmission Planning Cal SO Perspective – Dariush 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
- 4:00-4:45 pm Discussions, Q&A – All
- 4:45-5:00 pm Next Steps & Feedback – Yen/Porter
August 15\textsuperscript{th} 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

Final results early 2007
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