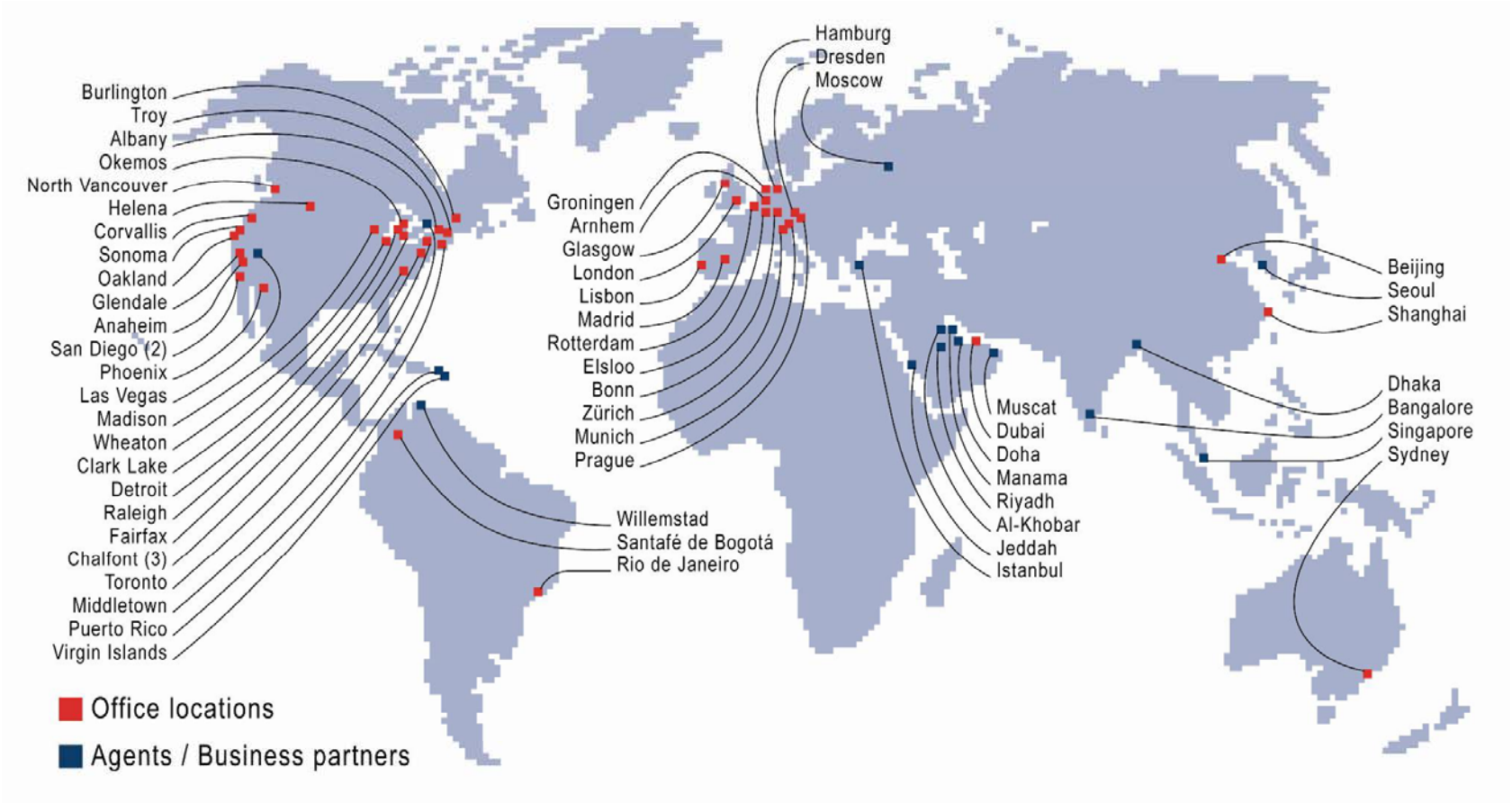
Renewables Forecasting & Integration

December 16, 2011 PIER Workshop

We change the world of energy

Experience you can trust.

Around the Globe



- Since 2008, we've served more than 1600 different customers in more than 100 countries
- More than 1700 staff with offices and representation in more than 20 countries

Covering the Entire Energy Value Chain

Policy & Strategy

Production

Trading

Transport & Distribution

Use

One company serving the diverse needs of the energy marketplace

Our services

- Consulting, technical & operational services
- Inspections, assessments, testing & certification
- Research & innovation

Our customers

- Energy supply industry
- Energy intensive users
- (Power equipment) manufacturers
- Transportation (e.g. rail, e-mobility)
- Financial institutions and development banks
- Authorities and regulators

Contents

1. What KEMA is doing?
   - CSP-TES Modeling
   - CA EU DG Study
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   - Predictive AGC
2. Future R&D Needs

CSP-TES Modeling- PIER 1/2

Purpose: Define the benefits, costs, impacts of increasing penetration of coupled CSP-TES, along with the system configurations and control strategies needed to optimize economic and engineering performance.

Background: CSP developers and operators have experience in plant-level system decisions, but lack grid-wide perspective; grid operators has the grid perspective, but lack experience in integrating CSP-TES

Project: Bridge the gap by end-to-end system modeling spanning from the plant to grid

Timeline: June 30, 2011to December 31, 2014

CSP-TES Modeling- PIER 2/2

Project Steps

1. Define Grid-Relevant Economics
2. Plant-Level Thermodynamic Modeling of Multiple CSP-TES Configurations
3. Parameter-Based Optimization
4. Model Grid Linkages and Develop Control Algorithms
5. Develop Market Simulation Models of CSP-TES
6. Simulate Market Outcomes

EU DG Study- CEC and CAISO 1/2

Purpose: Comparison between the electric distribution systems in Europe and California to determine the differences that affect California's ability to successfully integrate more intermittent DG in California's grid.

Background: Governor's Clean Energy jobs Plan sets a goal to develop 12,000 MW of localized electricity generation by 2020.

Project: Comparative analysis of how Germany and Spain integrate large quantities of intermittent DG into their electric distribution systems while still maintaining system control and reliability.

Timeline: January 1 to December 2011

EU DG Study- CEC and CAISO 2/2

Report (Scheduled to be published this month)

Topics covered:

1. Comparison of Physical Grid Infrastructure and Interconnection Requirements in Germany and Spain
2. Network Planning and Operations Impacts of Distributed Generation, including forecasting, standards on frequency control and balancing services.
3. DG on Public Property
4. Lessons Learned

DER Visibility & Control Study- CAISO 1/2

Purpose: Evaluate market impacts, operational benefits, and quantify the costs associated with integrating DER, including PV, CHP, wind, EV, storage and demand response.

Background: Requirements for intermittent resources on the distribution network is not well-defined. The aggregate impact could significantly impact balancing, capacity planning and regulation.

Project: Run market simulations with different scenarios of DER penetration.

Timeline: August-December 2011

DER Visibility & Control Study- CAISO 2/2

Project Steps

1. Modeling: Define operational scenarios, current requirements, and current penetration level baseline. Analyze variability of existing DER profiles (PV). Develop scenarios for how to exploit some of the controllable DER types
2. Simulate scenarios from above to compare costs and benefits
3. Develop technology roadmap and costs/benefit analysis from simulation results

Results

- Will be published in early 2012

Predictive AGC - CAISO 1/2

Purpose: Identify the operational benefits and costs of applying modern control theory to automatic generation control with regard to integrating 33% renewables by 2020.

Background: Traditional AGC algorithms are inefficient at providing regulation with high penetrations of variable renewable power because they do not use all relevant system information

Project: Use KEMA's KERMIT model to test new AGC algorithms that predict generator, renewable, and system performance

Timeline: January 1, 2011 to December 31, 2011

Predictive AGC - CAISO 2/2

Project Steps

1. Model CAISO system with 33% renewables
2. Develop short-term renewable forecasts
3. Design AGC algorithms based on modern control theory
4. Integrate new AGC algorithms into KERMIT
5. Simulate CAISO system

Thank you for your attention

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